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AND DIMENSION
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AND CANADA'S
TRUCKING
INDUSTRY

Case Histories

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Case Histories

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A. M. Clayton
B. G. Bisson
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December 1986

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Case Histories

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17. Abstract

Over forty case studies are presented to demonstrate the controlling influence of the various provincial vehicle weight and dimension regulations on the composition of truck fleets in Canada. An analysis of the case studies explores the impacts of single and multiple regulatory regimes; the direct and indirect influence of U.S. regulations; the effects of regulatory changes; enforcement practices; and the impacts of such factors as freight, route, terminal and shipper characteristics on fleet composition.

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17. Résumé

Ce rapport présente plus de 40 cas d'espèce étudiés pour mettre en évidence l'influence de la diversité des réglementations provinciales du camionnage sur la composition des parcs camions. Une analyse de ces cas montre la situation existante due à la multiplicité et la diversité des réglementations, ainsi que l'influence directe et indirecte de la réglementation des Etats-Unis; elle traite aussi de la conséquence des changements dans les réglementations, de l'effet des modalités variables d'application et, enfin, de l'effet de facteurs spécifiques: nature du fret, itinéraires, caractéristiques des terminus et des transporteurs, sur la composition des parcs camions.

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Preface

This report is a background paper for a study of Canada's vehicle weight and dimension regulations. It presents a series of case histories developed from interviews with carriers, private truckers, and manufacturers across Canada. Earlier phases of the study included an analysis of the existing regulations, a review of previous research, an investigation of available data sources, and an analysis of the productivity and operational implications of vehicle weight and dimension regulations. All of these topics and the resulting background papers will be incorporated into a final report.

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1. Introduction

The purpose of this study is to examine the relationship between weight and dimension regulations ("VWD regulations") and trucking. To do this, the work has been divided into a number of phases. The Summary ofthe whole project is being published as an independent volume. The five phases preceding this one are:

- "Analysis of Canada's Vehicle Weight and Dimension Regulations" **(1)**, containing a detailed summary as of the fall of 1985. This paper has been sent to the provinces for review; a revised version will be prepared shortly.

- "Previous Research" **(2)** which is a summary and critique of previous Canadian research into the issue of the benefits associated with changing weight and dimension regulations (ie, allowing larger or heavier trucks).

- "Availability of Provincial Data" **(3)** which is an assessment of the availability of data. This is a "procedural" phase only, in the sense that it had to be undertaken to make a decision as to whether or not to proceed with the next phase of the research.

- "Analysis of Registration & Road-Side Survey Data" **(4)** which contains an analysis of available data (both provincial and federal). Although there are gaps in the data, the available figures suggest that the number of large (over 30,000 kg) trucks in Canada is in the range of 85,000-90,000.

- "Productivity/Operational Implications of Vehicle Weight and Dimension Regulations" **(5)** which shows what happens to trucking costs as regulations permit different types of trucks to operate.

These preceding phases laid the groundwork for understanding much about the relationship between the regulations on the one hand and the truck fleets on the other. However, there are still aspects of this relationship that cannot be understood from just this work. In particular, the trucking industry operates various types of trucks for a number of reasons -- the influence of weight and dimension regulations, while a controlling factor, is only one of several forces at work. So, for example, while the preceding work in Phases #1 to #5 might be helpful in drawing up a list of the "most productive" truck types in each province, or a list of "legal" configurations in each jurisdiction, it would not be sufficient to make a prediction as to the actual composition of truck fleets.

Factors other than weight and dimension regulations which are at work in influencing the actual composition of fleets include:

- Freight characteristics such as density, packaging, the ability to gravity flow, dry/liquid, etc. For example, a carrier may chose not to use double 27' pups as it sometimes has to haul 40' pipes as a backhaul.
- Terminal characteristics such as docks, manoeuvering space, loading/unloading mechanisms, etc. For example, some terminals are not designed to

handle tractors with dromes, other terminals do not have enough manoeuvering space to handle doubles.

- Route characteristics such as short versus long hauls, highway class, peddle versus point-to-point runs, etc. As an example, a carrier may chose to use one type of axle on trucks used on intercity hauls and another type on trucks which spend their time in urban areas.

- End-point characteristics at origin or destination, independent of terminals. For example, some truck operators avoid wide-spread tandems where they have to operate in small yards with gravel or earth; wide-spread tandems damage these yards.

- Vehicle characteristic such as operating costs, original purchase price, the price of a used vehicles, the expected resale value, operational and handling characteristics, etc.

- Shipper characteristics (which may overlap with some of the previous factors) such as a shipper who prefers to and is set up to ship in quantities that just fill a 45' van. In this situation, there is little point for the carrier to buy the newer and more productive 48' vans.

- Industry Characteristics such as management practices or the way some segments of the trucking industry are organized. For example, some segments of the industry rely on owner-operators which determines to some extent the configuration types and/or trailers sizes that are used.

In an attempt to understand these factors, and in doing so the role of weight and dimension regulations, this phase of the work consisted of a series of interviews with truck operators and trailer manufacturers in all parts of the country. This paper contains the notes, sketches, and pictures obtained from this work. The material is organized as follows:

- An overview (Section 2) by Fred Nix and Alan Clayton that compiles the information obtained in a structured fashion.

- Case studies from Atlantic Canada by Barry Bisson (Section 3).

- Case studies from Quebec and Ontario by Fred Nix, with assistance from Alan Clayton in conducting some of the interviews (Section 4).

- Case studies from Manitoba by Alan Clayton (Section 5).

- Case studies from Saskatchewan and Alberta by Gordon Sparks (Section 6).

- Case studies from British Columbia by Fred Nix (Section 7).

As this is a working paper, little attempt has been made to integrate the style of the various authors. Nevertheless, there are some points to note about the presentation of material:

i. **Units of measurement:** The text has been written with the units of measurement used during the interviews. The result is that the text contains a mixture of Imperial and metric measurements.

ii. **Regulations:** Although aspects of the VWD regulations are explained and/or discussed at various points, as a general rule, the text has been written under the assumption that the reader will be familiar with Background Paper #1.

iii. **Conflicting Opinions and/or Facts:** There are instances where the opinions and/or "facts" expressed in one case study conflict with -- or appear to conflict with the material in another case study. No attempt has been made to reconcile these conflicts. For example, is the difference in tare weight between an A-train and a B-train significant?

iv. **Repetition:** Little effort has been made to eliminate repetition in the case studies. A point made by one of the firms was often raised by several others.

v. **Definitions:** Although there are instances in the following pages where consistent terminology has not been followed, there has been an effort to use certain words in a consistent manner. Definitions are contained in Background Paper #1. As examples: the terms "drawbar," "hitch", and "tongue" are used to mean the same thing (the mechanism that is used to attach one vehicle to another) and are used interchangeably in the text; the terms "triple axle" and "tri-axle", on the other hand, have quite distinct meanings *-- the difficulty being that in practice many people use these words interchangeably; and, terms such as "inner spread" and "outer spread" have been given precise and distinct meanings by the authors, but there is little assurance that other people or even the authors are using these terms consistently.

vi. **Configurations:** Although configuration types have been defined in Background Paper #1, there are a few points that bear repeating here. The term "truck" (or "trucks") is used in a general sense in the text to mean all types of commercial-freight-carrying vehicles: straight trucks, tractor-semitrailers, A-trains, etc. The term "double" is used to mean a vehicle combination with two freight-carrying containers -- a truck-plus-trailer (a 2-vehicle combination) or a train (a 3-vehicle combination). Configuration types in the text are often identified by codes such as "3-S2". The numbers in these codes refer to the number of axles in each vehicle in the combination and the "S" refers to a fifth wheel. A "3-S2", then, is the standard 5-axle tractor-semitrailer.

vii. **The territories:** Given the nature of the regulations, in Section 2 the Northwest Territories is considered to be in the "Prairie" region and the Yukon is considered the same as Ontario. In other parts of the text, the terms "provinces" or "provincial" is used to mean both the provinces and territories.

---

* *In those provinces permitting their use, a triple axle is three evenly spaced axles designed to approximately share loads whereas a tri-axle consists of a tandem plus another single axle -- often a liftable single axle for empty and/or a 90 degree turn.*

Finally, as a last introductory note, readers are advised that this is a working paper. Not all "facts" have been or can be verified, not all leads suggested in the interviews have been investigated, and not all information collected has been assimilated into understanding of the issues. One of the main purposes of this paper is to set down what is known at this stage and circulate the text for comment. It would be appreciated if readers would direct their comments to one of the authors listed on the title page.

2. Overview

2.1 INTRODUCTION

Many factors influence choices made with respect to fleet configurations: freight, terminal, route, end-point, vehicle, shipper, and industry characteristics. Working with all of these factors, weight and dimension regulations in each province and/or territory exercise a controlling influence. The interest here is to show how a number of case studies demonstrate the influence of these regulations. To do this in a structured fashion, information from the case studies has been assembled into a series of topics:

i. **The Impact of Single Regulatory Regimes** -- where two types of trucking are examined in detail to show how different regulations in each province affect fleet choice, independent from the impact of other factors (changes in regulations over time, influences of regulations from more than one jurisdiction, enforcement considerations, all the other non-VWD factors listed previously). To the extent that it is impossible to hold these other factors constant, this examination of the "pure" effect of regulations is less than perfect. Nevertheless, Section 2.2 is a good introduction to the subject -- two trucking situations, representative of weigh-out and cube-out freight, common to all provinces, and configurations resulting from each province's regulations.

ii. **The Impact of Multiple Canadian Regulations** -- where the scope is broadened to show what happens when more than one set of Canadian regulations influence the choice. These multiple regulations exist: (a) within one province, (b) between two or more provinces sharing common VWD regulations, (c) between two or more provinces having quite different types of regulations, or (d) in cross-Canada trucking situations where all regulations come into play.

iii. **The Impact of U.S. Regulations** -- where the direct and indirect influence of U.S. regulations is examined.

iv. **The Impact of Changes in Regulations** -- although the material collected from the case studies in not sufficient to provide a full explanation as to what happens as VWD regulations change over time, the temporal aspects of the regulations cannot be ignored. Some aspects of current fleets cannot be understood without understanding how truck operators have become used to or are subject to the process of change.

v. **The Impact of Regulations Given Enforcement Considerations** -- as with the previous topic, the topic of enforcement cannot be fully explored here: not enough is known. The subject, however, is too important to ignore. In a significant number of the interviews, the subject of enforcement was brought up; it seems that fleet selection is made, in part, on the basis of enforcement considerations. Section 2.6 is a series of observations on the issue of enforcement, with no attempt at "conclusions" or "lessons".

vi. **The Impact of Other Factors on Fleet Selection** -- where all the information obtained on "other" (ie, non-VWD regulations) factors is summarized. This section is a partial examination of these other factors. That is, the purpose of the case studies was not to write the definitive analysis of how, for example, freight characteristics affect vehicle choice. Rather, the purpose was to understand how VWD regulations affect fleets in the face of freight characteristics. This section summarizes the views, opinions, and observations collected from the interviews on these other factors.

2.2 THE IMPACT OF SINGLE REGULATORY REGIMES

Different sets of regulations affect fleet selection, independent of regulatory change over time, independent of conflicting (more than one) regulatory regimes, and independent of all the other non-VWD factors. Because it is impossible to isolate the impact of regulations from all these other factors, the best way of showing these "pure" effects of different regulations is to select a number of situations where truck transportation is more-or-less similar in all provinces and where vehicles have been designed to operate within the confines of one regulatory regime.

Two types of trucking are used to demonstrate these pure regulatory effects: petroleum products (bulk gasoline and diesel delivered to retail outlets) representing a heavy/dense commodity where weigh-out considerations govern; and LTL general freight representing light or low-density commodities where cube-out considerations govern. There are many other situations that could be used to demonstrate these pure regulatory effects (milk hauling, beer distribution, gravel trucks, etc.), but the two examples used here suffice to demonstrate the main differences among Canadian regulatory regimes.

2.2.1 Petroleum Haulers

Generally, trucks built for hauling petroleum products are built for the regulations of one province, or in the case of Atlantic Canada and to a lesser extent the Prairie provinces, one region. These vehicles are built to take advantage of the maximum load allowed under the regulations. The configurations shown in Table 2.2.1 are typical of the vehicles used in each region -- they are not the only types. For this reason some care has to be taken in making too much of the differences shown. This cautionary note aside, there are some points to make about the various configurations and the differences in provincial regulations:

i. **Atlantic:** It is believed that tractor semitrailers are used instead of trains because: (a) the regulations allowing their effective use are more recent than in other parts of the country and are still not as conducive to the operation ofdoubles as elsewhere; (b) with a GVW of 48,500-50,000 kg, a 3-S3 is close to the effective regional maximum GVW allowed (ie, given the 50,000 kg limit in Nova Scotia); and (c) even in New Brunswick, where 56,500 kg is allowed on major highways, a GVW of 50,000 kg is the effective maximum for petroleum haulers given that a number of their destinations would be on the lower class roads with maximum GVWs of 50,000 kg.

	Atlant.	**Que.**	**Ont. (1)**	**Ont. (2)**	**Ont. (3)**	**Man.**	**Sask.**	**B.C.**
Config.	tr-semi 3-S3	tr-semi 3-S3	B-train 3-S3-S2	B-train 3-S2-S2	tr-semi 3-S4	A-train 3-S2-2	A-train 3-S2-2	B-train 3-S3-S2
GVW	50,000	54,350	63,500	62,100	61,230	55,200	53,500	63,500
Tare								
- tractor	8,618	8,618	8,810	8,810	9,000			9,072
- trailers	8,437	8,437	11,100	10,150	9,600			11,453
- total	17,055	17,055	19,910	18,960	18,600	18,144	18,144	20,525
Payload								
- kg	32,945	37,295	43,590	43,140	42,630	37,056	35,356	42,975
- litre	44,823	50,741- 51,000	59,306	58,694	58,000	50,416- 50,901	48,103- 48,539	58,100- 58,469
Dimensions								
- height (m)			3.58	3.60	3.60			3.58
- length (m)		19.94	21.46	21.46				21.58
Axle Load (kg)								
- #1	6,000	6,350	7,005	7,500	6,500	5,000	4,500	5,500
- #2-#3	17,000	19,000	17,055	18,500	18,310	16,000	15,750	17,000
- #4					9,155			7,000
- #4-#5				19,100		16,000	15,750	
- #4-#6	27,000	29,000	20,860					
- #5					9,155			
- #5-#6								17,000
- #6						9,100	8,750	
- #6-#7				17,000	18,310			
- #7						9,100	8,750	
- #7-#8			18,580					17,000

Table 2.2.1 Typical Petroleum Tank Trucks

ii. **Quebec:** Although trains are used to distribute petroleum products, 3-S3's are more common. There are several varieties; the one shown is distinguished by its wide-spread (72") tandem-drive axles allowing 19,000 kg and its tri-axle on the semitrailer with an outer spacing of greater than 4.8 m and an allowed load of 29,000 kg. Triple axles are also used on semitrailers -- with outer spacings of 4.8 m, and loads of 30,000 kg -- but it is understood that they are used more on highway operations and less on urban deliveries. The reason trains are not used more frequently, it is thought, is that the additional GVW available (about 3,000 kg to the maximum 57,500) is not worth the extra expense given that at least half of the increased GVW would be accounted for by tare weight.

iii. **Ontario:** *Typical* is a tricky word to use in the context of Ontario because of the wide variety of possibilities allowed under the regulations. Nevertheless, the three shown are all common -- or, in the case of the 3-S4, are becoming common. There are several points to note: (a) 7-axle vehicles can have almost as large a payload as 8-axle (it can be shown "on paper" that this is possible); and (b) the tractor-semitrailer is considerably less expensive than the trains ($15,000) and can carry almost as much payload, but is less manoeuverable in some of the smaller retail delivery points.

iv. **Prairies:** Trains are used wherever high GVWs are required. Unlike Ontario or Quebec, tractor-semitrailers cannot be registered with GVWs at or near the maximum, leaving doubles the only choice for heavy\dense loads. A-trains are used for petroleum hauling in Manitoba and Saskatchewan for a number of reasons -- some of these are discussed in later sections (two sets of regulations within one jurisdiction, the impact of U.S. regulations). To some extent, then, the configurations shown in Table 2.2.1 are not perfect examples of the "pure" effect of one jurisdiction's regulations. In Manitoba, another reason for choosing A-trains is that since 1982, A-trains have had a payload advantage over B-trains (GVW maximums of 56,500 kg versus 53,500). Alberta, which is not shown, has vehicles identical to those in Saskatchewan with one possible modification -- wider spreads on the tandem. It is not known how many operators actually opt for these wider spreads.

v. **British Columbia:** Eight-axle and some 7-axle B-trains are used to haul petroleum products. Doubles have to be used to register a vehicle at the highest GVW; a tractor-semitrailer is limited to 6-axles (5-axles if a 48' semitrailer is used), an overall length of 20 m, and a GVW of 52,200 kg in B.C.* The 3-S3-S2 shown for B.C. is not the same as the 3-S3-S2 shown for Ontario. In particular, because of British Columbia's axle spacing and self-steering requirements (for 3-axle groups), the B.C. B-train has a single-plus-tandem on the lead semitrailer. The Ontario B-train has a triple axle on the lead semitrailer.

Although the effect of changing regulations, different sets of regulations, and other non-VWD factors are all evident in the choice of these tank trucks, they have been normalized to some extent by concentrating on a type of trucking that is common in each region. Imperfections in this process of normalization aside, different regulations result in distinct vehicle types. There are, one would assume, some significant differences in everything from operating costs (delivery cost per litre), to pavement impacts (EALs per delivered tonne), to safety (centres of gravity), etc. arising from these different vehicles types -- which in turn arise (largely) from the different regulatory regimes.

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* *This ignores some definitional problems as to what a tractor-semitrailer with a jeep and possibly an extender should be called.*

2.2.2 LTL General Freight Carriers

LTL carriers select equipment designed to maximize cube. Given that height and width limits are almost uniform across the country (4.15 m and 2.6 m respectively), maximum cube is a function of available trailer length. There are five regulatory elements controlling the amount of trailer length available: (a) limits on the length of individual vehicles (eg, semitrailers generally restricted to 14.65 m); (b) length limits on vehicle combinations (eg, 20 m for tractor-semitrailers in some provinces versus 23 m for doubles); (c) limits on the kingpin-to-rear (the 16.75 m limit in some situations); (d) limits on the rear-of-the-cab-to-rear (the 19 m limit in Quebec and Ontario); and (e) restrictions on load-carrying devices ("dromes") on tractors (an issue not fully understood).

In Table 2.2.2 the available trailer lengths, indicative of available cubes, are shown for each region under three headings:

i. **Typical Trailer Lengths:** From Ontario east, the 48' semitrailer appears to be (or is becoming) the standard for many LTL carriers, although some of the larger (national) LTL carriers are using double 27' (and sometimes double 28') pups in Quebec and Ontario. It is understood that doubles are not common in Atlantic Canada because of the difficulty of configuring them within the prevailing 21 m length restriction. In Western Canada, the double 27' and sometimes 27' + 28' combinations are far more common -- it is not known if they outnumber the 45' (increasingly 48') van in LTL trucking.

ii. **Possible Trailer Lengths:** Without attempting to be precise about the dividing line between "typical" and "possible", it is simply noted that (a) 54' through the use of double 27' pups is theoretically possible in Atlantic Canada, given the use of short wheelbase tractors (roughly less than 137") but there are a several of factors inhibiting their use (the desirebility of tractors with very short wheelbases, the non-acceptaince of A-trains unless by special permit); (b) 66'4" is not only possible in Quebec and Ontario but is also being realized by at least one carrier through the use of 48' semitrailers and 18'4" dromes; and (c) 56' is possible "on paper" in Western Canada through the use of double 28' pups, but in practice the kingpin setbacks are so large (4' or more) and the landing gear is so far back that the pups tend to be "nose heavy" (no true 28' double combinations were seen in this research)*.

iii. **Special Permit Vehicles:** In the last column, the available cube from special permit vehicles is shown where these vehicles are allowed to operate (on designated roads and under a series of conditions).

Again, as was the case with tank trucks, these typical (and to some extent "possible") LTL configurations are not always the "pure" result of one province's regulations. Nevertheless, they come close to normalizing the many other factors at work to show how different regulations affect fleet choice and result in significantly different configurations (double 27's, tractor-semitrailers, and tractor-semitrailers with dromes).

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* *One carrier interviewed did use double 28' with tapered ("bullnosed") pups, giving an effective floor length of roughly 27'. Another carrier has had a fleet of B-train doubles with a total useable lenth of 55.5' -- these configurations were found to exceed the 16.75m limit by 6".*

Region	Typical Trailer Lengths	Possible Trailer Lengths	Special Permit Vehicles	Notes
Atlantic	48'	54'	X	- 48' the coming standard - double 27' possible
Quebec	48'- 54'	66'4"	96'	- 48' the coming standard - 66'4" now operating in 18'4" drome + 48' semi's - 96' turnpike doubles by special permit
Ontario	48'- 54'	66'4"	X	- 48' the coming standard - 66'4" now operating in 18'4" drome + 48' semi's
Prairies	54' 55'	56'	81'- 96'	- 2 X 27' or 27' + 28' are standard - 2 X 28' are "difficult" - triples, Rocky Mountain & turnpike doubles under special permit
B.C.	54'- 55'	56'	X	- 2 X 27' or 27' + 28'are standard - 2 X 28' are "difficult"

Table 2.2.2 LTL General Freight: Available Trailer Length

2.3 THE IMPACT OF MULTIPLE CANADIAN REGULATIONS

The previous section showed, as one would expect, that different regulations lead to different fleets. In this section the scope is broadened to show what happens when more than one regulatory regime influences choices. Regulatory change over time and the impact of U.S. regulations are considered later.

To show how different sets of Canadian regulations affect fleet selection, the subject is divided into several areas: (a) within one jurisdiction where such things as primary/secondary road regulations or winter/summer regulations result in vehicles operating under two (or more) regulatory regimes; (b) within several jurisdictions that have similar regulations but where there are minor differences among the regulatory regimes (eg, Atlantic Canada, or the Prairie provinces); (c) within several jurisdictions where there are significant differences among the regulations (eg, Atlantic-Quebec, or Ontario-Manitoba); and (d) within many jurisdictions where all regulatory differences have an influence on the choices (eg, cross-Canada).

When confronted with multiple regulations, a carrier has two choices: select a vehicle with the "least common denominator" of the regulations governing, or select a vehicle that can be modified to operate under multiple regulations. Modifications can be made with various devices on the vehicle (sliding fifth wheels, moveable kingpins, liftable axles, sliding axles, extendable tongues, etc.) or through various operational procedures (loading, bobtailing, etc.). In either case, trucking costs increase -- higher capital costs, higher tare weights, empty miles, higher loading costs, etc.

2.3.1 Different Regulations Within One Jurisdiction

Within a province, different regulations may exist for different road classes, different seasons, and for other reasons (see Background Paper #1). These multi-layered regulations affect fleet selection.

For example, considering provinces having different regulations for different classes of roads ("primary" versus "secondary" -- although each province has its own nomenclature), one carrier in Nova Scotia selects 3-S2's rather than the more productive 3-S3 because the regulations only allow 17,000 kilograms on any axle group on secondary roads. Three axles on the semitrailer would be superfluous. As another example, carriers in the Prairie provinces opted for A-trains in the 1970s instead of B-trains because A-trains can be easily dis-assembled to conventional 3-S2's: when doubles first became widely feasible (1974/75), the differences in allowable GVWs and axle loads for primary versus secondary roads meant that carriers wanted equipment that could be converted easily and used on either road system. Now that the distinction between primary and secondary roads has become less important, at least one of the carriers interviewed is considering moving back to B-trains.

Considering provinces which have different regulations for different seasons of the year (possibly higher axle loads or GVWs in the winter, lower axle loads in the spring, and "normal" loads for the balance of the year), several carriers indicated how this situation affected their decisions. A carrier in New Brunswick which only requires 3-S2 equipment for some of its hauls (ie, given the payload available) selects some 3-S3 equipment because of the spring weight restrictions. That is, since the restrictions limit axle loads to a percentage of the normal load, X% of a 3-axle load is better than X% of a tandem-axle load in the spring. The carrier operates for most of the year, then, with more expensive and heavier equipment than is really necessary. A Manitoba-based carrier uses 7-axle A-trains (3-S2-2) rather than the more productive 8-axle variety (3-S2-3) because, among other things, it can get the maximum GVW (56,500 kg) on the 7-axle combination for several months of the year given the 10% winter premiums. In other words, the carrier believes that the extra cost of switching to 8-axle equipment is not worth it given that he can already get the highest GVW available for part of the year.

None of these examples is particularly dramatic, but there is an important point here that is not generally appreciated. Provinces have a lot of choice in terms of the "layers" within their regulations; from a highway perspective, there may be good reasons for this multi-layeredapproach to VWD regulations; but, there is a perception that those who promulgate these multi-layered regulations do not realize what they are doing to trucking fleets when they take this course. The impact on trucking fleets may be good, bad, or neutral -- the point is that there does not appear to have been much, if any, analysis of this prior to the development of "layers."

2.3.2 Different Regulations Among Similar Jurisdictions

Within Atlantic Canada and within the Prairie provinces there are some broad similarities in each of the regulatory systems. Nevertheless, there are small differences among the provinces within these two regions that do affect fleet selection.

Only one example of this was found in Atlantic Canada: a carrier hauling salt for the New Brunswick Department of Highways uses 3-S2 combinations rather than the more productive 3-S3 because the salt originates in Nova Scotia on secondary roads where the maximum axle load for any group of axles is 17,000 kg. There is no point in using 3-S3's because the semitrailer axles could only be loaded to 17,000 kg.

Few specific examples of where the minor differences in the regulations among the three Prairie provinces are affecting fleet choices have been determined. However, it is speculated that Manitoba's higher GVW for A-trains may affect the number of A-trains operating across the Prairies, and that Alberta's slight encouragement of wide-spread tandems may have an impact on fleets used in other Prairie provinces. On the first point, one of the Saskatchewan carriers interviewed has purchased 8-axle A-trains in the hope of obtaining special permits to operate them in Saskatchewan at the Manitoba GVW limits -- the eighth axle gives the carrier no advantage in Saskatchewan, in fact there is a payload penalty because of the extra tare weight.

2.3.3 Different Regulations Between Dissimilar Regions

There are significant regulatory differences between Atlantic Canada, Quebec, Ontario, the Prairies, and British Columbia. The most important (but far from only) are:

- There are more restrictive length limits for doubles in Atlantic Canada (21 m versus 23 m elsewhere); and, there are more restrictions on trains in Atlantic Canada than elsewhere (ie, B-trains only unless operating under special permit).

- The length limit for tractor-semitrailers in Quebec and Ontario is longer than in other provinces (23 m versus 20-22 m).

- Loads allowed on tandems are lower in Western Canada (16,000-17,000 kg) than those in Eastern Canada (18,000-20,000 kg).

- There are constraints on using 3-axle semitrailers in the Prairie provinces (elsewhere they are permitted with loads higher than tandem-axles).

- There are major differences in the treatment of 3-axle groups in Atlantic Canada versus Quebec/Ontario versus British Columbia (ie, a relatively rigid number of possibilities in Atlantic Canada; many possibilities and high loads in Quebec and Ontario; and self-steer requirements in British Columbia plus an effective prohibition pertaining to 48' semitrailers).

- There is an effective prohibition on semitrailers with more than three axles in all provinces except Quebec and Ontario with the consequence that it is generally not possible to reach the maximum GVW with tractor-semitrailer combinations in any place except Quebec and Ontario.

- There are significantly different methods used in each of these five regions to calculate allowable GVWs.

As examples of how these differences affect fleet choice, consider:

i. A carrier in Ontario hauling steel to Western Canada has selected a number of combinations designed to work at maximum GVWs in both Ontario and the Prairie provinces. One of these, an 8-axle B-train, is described in detail in Section 4.7. The vehicle has been built at a cost of $15,000 more than would have otherwise been necessary if it was designed to operate only within the regulations of one of these regions. The different regulations also have a impact on the operating procedures used with this B-train -- these procedures include some bobtail runs between Winnipeg and the Ontario-Manitoba border (running back to pick up the pup trailer, after the lead semitrailer has been taken into Winnipeg). This is an instance of where a carrier has chosen to pay the extra expense (capital and operating) associated with a vehicle that can be modified enroute to operate efficiently within two significantly different sets of regulations. Another aspect of this carrier's operation to note is the wide variety of configuration types operated, the variety caused in part by the multiplicity of regulations. While no quantitative information on this was obtained, it is assumed that this is a more expensive alternative than operating a fleetof more-or-less standard configurations.

ii. Many carriers on Western Canada-to-Ontario operations opt for combinations which exhibit the least common denominator of the two sets of regulations. Typically, this is a 7-axle A-train operating at 53,500 kg. For a thousand miles of this haul, that vehicle is operating beside configurations such as 8-axle trains with GVWs of 63,500 kg and payloads up to 25% higher (in the extreme, 95,000 versus 76,000-78,000 lbs.).

iii. Another area where carriers opt for the least-common-denominator is the Atlantic Canada-to-Quebec/Ontario corridor. Carriers on this lane use 3-S2 or 3-S3 configurations because of the 21 m length limit in New Brunswick and Nova Scotia and the discouragement of A-trains. Higher cubes and GVWs are possible for some types of freight if trains or tractor-semitrailers with dromes were to be used. To show just what the impact of operating a configuration among a number of jurisdictions with different regulations can be like, consider a 3-S3 operating on this Atlantic Canada-to-Central Canada corridor. The following figures show the axle loads, GVW, payload, and axle spacings required at maximum GVWs for a 6-axle tractor-semitrailer with a tare weight of 17,000 kg, a 5,000 kg front axle, 60" drive tandems, and 72" semitrailer tandems. These are ***strict*** interpretations of the regulations.

	axle loads (kg)			**GVW**	**Payload**
	front	**drive**	**tri-axle**		
Ont	5,000	17,900	29,100	52,000	35,000
Que	5,000	18,000	29,000	52,000	35,000
NB	5,000	17,000	27,000	49,000	32,000
NS	5,000	17,000	27,000	49,000	32,000
PEI	4,990	17,010	27,215	49,215	32,215
Nfld	5,000	17,000	27,000	48,500	31,500

	axle spacing (inches)			
	#1-2	**#3-4**	**#4-5**	**#4-6**
Ont		130 (if axle #1-#6 = 581)		
		142 (if axle #1-#6 = 571)		
Que	177	189		
NB	130	167	189	
NS	118	167	191	
PEI	120	168	120	
Nfld	120	167		189

iv. As another example of the impact of two sets of significantly different regulations, consider the tank truck operator in Atlantic Canada who purchased a used trailer from Quebec. Because of the different approaches to axle spacing in Quebec, the combination did not fit within the Atlantic regulations -- the distance between the last drive axle and the first semitrailer axle was less than the required 4.25 m. Different sets of regulations affect the use of equipment in different provinces, and as a consequence such things as resale values for equipment or even the capital cost of equipment in some provinces (ie, if a carrier can't buy an inexpensive used vehicle, it is forced to buy a more expensive new vehicle designed specifically for certain provinces).

v. Axle spreads are another area where choices have to be made when operating between regions with significantly different regulations. In the West, some carriers operating between the Prairies and B.C. have tried wider tandems (1.5 m or more) -- at least one carrier did not think the higher payload (1,000 kg) for only some portions of some trips (intra British Columbia) was worth the extra expense associated with higher tire wear. Operating from the Prairies to the East, several of the carriers interviewed do use wide-spread tandems in order to carry higher axle loads in Ontario (and points east) -- presumably this is only feasible for carriers with some eastern operations as the wide-spread tandems do not permit higher loads for freight with an origin or destination on the Prairies.

2.3.4 Different Regulations Across Canada

Some types of trucking involve selecting fleets that can operate across Canada. Two examples apparent from the case studies are the household goods carriers and the LTL general freight carriers.

Household goods carriers, requiring cube more than weight, have opted for the least-common-denominator approach to the regulations, typically using 3-S2 equipment with 48' semitrailers. These configurations are used as they fit within the 20 m length restriction for tractor-semitrailers in the most limiting provinces (doubles are not generally feasible for a variety of institutional reasons). Typically, these combinations provide upwards of 4,000 cubic feet. However, these same configurations with drome boxes (18 plus feet) are legal in two provinces at 23 m and provide up to 5,000 cubic feet in payload -- a 25% increase in potential payload.

LTL carriers select fleets for a number of reasons. The point to note about the large LTL carriers, selecting fleets for cross-Canada operations, is that double 27' pups meeting the 16.75 kingpin-to-rear limit seem to be a common choice. In three provinces, this kingpin-to-rear restriction is not impeding the use of double 28's (this is a fairly recent change in one case), and in two others double 28's could possibly be run on the major highways under special permit. The apparent dominance of double 27's by national LTL carriers in Canada is evidence of the least-common-denominator approach.

2.4 THE IMPACT OF U.S. REGULATIONS

The previous section showed how fleet selection is more complicated when several Canadian regulatory regimes govern. Over and above this, U.S. regulations are important in the process of fleet selection. This occurs in two ways: the direct effect where a Canadian vehicle operates in the U.S. and therefore has to comply with U.S. regulations; and the indirect effect where U.S. regulations affect vehicles operating only in Canada *or* where U.S. regulations affect Canadian regulations.

In terms of the direct effect, there are two observations. First, in both Eastern and Western Canada carriers with U.S. operations are choosing the traditional 3-S2 because of the U.S. 80,000 lb. GVW limit (on the interstate system). These vehicles tend be less efficient than other vehicles when operating on the north side of the border (eg, when completing the New Brunswick-to-Ontario leg of a N.B.-Ont.-U.S.-N.B. movement). The second observation concerns Western Canada only. Here, because of the use of the "B Formula" by a number of states in setting allowable GVWs off the interstate system and because of the 80,000 lb. limit on the interstate, many Canadian carriers with U.S. operations have opted for A-trains instead of B-trains (and more recently C-trains). The reason is twofold: (a) an A-train with an extendable tongue can be stretched to comply with the requirements of Bridge Formula B; and (b) an A-train can be easily dis-assembled to 3-S2 configuration.

Other direct effects of U.S. regulations tend to be limited to particular vehicles in particular situations: examples of some of the combinations developed to operate under both Canadian and U.S. regulations are given in Section 7.2 and 7.4.

In terms of the indirect effect of U.S. regulations, several examples were mentioned during the interviews. The use of 96" running gear and in some cases 96" wide trailers is probably the best known instance of the indirect effect of U.S. regulations: for some years, even though Canadian regulations permitted 102", much of the running gear and some of the trailer frames were built to the U.S. standard 96". This is no longer an issue since the U.S. adopted the 102" standard in 1982.

A second instance of the indirect effect of U.S. regulations concerns the use of 48' semitrailers. It is understood that it was the American adoption of this standard in 1982 that caused the Canadian provinces to amend their previous limits. The indirect effect here is one of American regulations influencing Canadian regulations. Also, the wide-spread and rapid adoption of 48' semitrailers in the U.S. (according to people interviewed) has had an impact on the rate of adoption of 48' semitrailers in Canada. These 48' semitrailers are becoming the standard for some shipping groups and/or hauling situations.

A third example of the indirect effect of U.S. regulations concerns one Canadian LTL carrier. Apparently, because double 28' pups have become standard south of the border, the price of used 27' pups is low. As a result, this carrier has just purchased a large number of used American 27' pups. Here, then, is a situation where a change in U.S. regulations affects vehicle prices which in turn affects the type of configurations used in Canada. *

2.5 THE IMPACT OF CHANGES IN REGULATIONS

Previous sections have described how fleet selection is affected by one set or several sets of regulations. Another aspect of VWD regulations responsible for characteristics of current fleets is changes in regulations over time. There are several aspects to this: (a) the time it takes for regulatory change to work its way through the system --that is, is it *instantaneous* as is assumed in some of the analytical work? or does it take many years to work its way through the system? (b) the process of change creating an *anticipatory* mentality in those making the fleet decisions -- that is, people become so used to the process of change that they start to second-guess the regulators; (c) the scale of the regulatory change -- that is, the degree by which regulations have to change before truck operators decide to change their fleets; and (d) inefficiencies resulting from the process of change -- that is, instances of where the process of change itself leads to inefficiencies even where the change allows more efficient vehicles to operate. All four topics are complex and cannot be fully addressed here; the following sub-sections contain a summary of the observations collected on these topics.

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* *Some would argue this is not a true instance of the influence of U.S. regulations as 2 x 28' pups are difficult, if not impossible, to configure given the kingpin-to-rear limit. In other words, the carrier really had no choice but to select 2 x 27' pups and just happened to be lucky that prices were low. The person interviewed, however, maintains that 2 x 28's are possible within the 16.75 m limit and that his long-term goal is to switch to these units.*

2.5.1. The Rate of Adjustment

The time between a regulatory change and actual changes in fleets is hard to predict as a great number of variables are involved. Although this research has not uncovered any "rules" on this subject, the following points shed some light:

i. A major Western Canada-to-Ontario LTL carrier chose double 26' configurations in 1974 (in response to the Western Canada Highway Strengthening Program) -- these could be operated within the 65' length limit. While the carrier has since moved on to other configurations, both in response to changes in the length limits on the prairies and in response to Ontario's move to 23 m in 1982, the point is that today -- 12 years after the regulatory changes -- the carrier is still operating some of the double 26' pups.

ii. Two milk haulers (Atlantic Canada and Ontario) noted that their trailers have a life cycle of approximately 10-12 years, with one re-building of the trailer occurring half-way through. As these are relatively expensive (stainless steel) tanks, there is not much chance either of these carriers would modify their operations as a result of regulatory change until the existing trailers are retired.

iii. Some of the people interviewed in Atlantic Canada noted that they could respond more rapidly to regulatory changes involving axle loads than they could changes involving length limits. The reason: it is cheaper to do an axle-spread conversion than to prematurely replace a whole trailer.

2.5.2 Expectations

Some of the choices being made are not so much a product of existing VWD regulations as they were a function of anticipated changes in the regulations. Apparently, particularly on the Prairies, the number and frequency of significant regulatory changes since 1974 has established a definite *anticipatory* mentality. This process has been reinforced by the publicity given to the RTAC/CCMTA research (ie, carriers believe that the provinces are committed to introducing change as a result of this research). Examples of this *anticipatory* mentality are as follows:

i. A carrier in Manitoba is now buying all of its new equipment with spread tandems (72" on trailers and 60" on tractors) in the expectation that Manitoba and Saskatchewan will adopt the practice common in other provinces of allowing higher axle loads for wider spreads. Another Manitoba carrier is now using 60" tandems on all of its equipment under the same expectation.

ii. A Saskatchewan-based tank operator's latest purchase of 2-axle pup trailers includes tanks on the pups of sufficient size to allow for 3-axle loads, if and when the conversion to three axle is made possible by changes in the regulations.

2.5.3 The Scale of Change

No precise data was obtained on how large a change is required before truck operators will re-configure their fleets. The following, though, are some scattered observations on this aspect of change:

i. Several carriers in Atlantic Canada indicated that the difference between 45' and 48' semitrailers was not significant enough to make them scrap their old equipment. Their attitude was that they would use their existing 45' semitrailers until age dictated the need for replacement.

ii. One tank truck operator in Manitoba considered the increase in allowable GVWs from 110 to 125 kips significant enough to re-do all of its pup trailers, increasing their capacity from 3,000 to 4,000 gallons. With the change, the carrier could now haul at 121 kips. Interestingly, the carrier did not feel the addition of an eighth axle, to bring the GVW up to 125 kips, was worth the cost: the gain of roughly 4 kips to GVW would be offset by 2-3 kips of tare weight and the additional capital and operating costs.

iii. In a complex case -- it involves shippers' preference for 45' trailer loads and U.S. operations where 45' semitrailers weigh out -- a carrier from Western Canada is still using mostly 3-S2's with 45' semitrailers and GVWs of 80-82 kips. The carrier would consider switching to larger units if the GVW limit in Manitoba were raised to 140 kips (Ontario's limit). The interesting point here, complicated by the multiplicity of factors influencing the decision, is that even with Manitoba's increase to 125 kips, this carrier has not seen fit to alter its basic fleet configuration.

iv. One Western carrier used to break its doubles at the Ontario-Manitoba border when the difference in GVWs was 140 versus 110 kips. Now that the difference is 140:125, the carrier operates straight through to Southern Ontario at the Manitoba GVW limit. Apparently, then, a difference of 15 kips in GVW is not worth the additional costs of running a tractor out from Winnipeg to pick up a pup trailer at the border. (This is true for this carrier; others still do find it worthwhile to split doubles at the border.)

2.5.4 Inefficiencies Resulting From the Process of Change

Most regulatory changes have allowed the use of more productive trucks. However, as one carrier noted, one effect of the constant series of changes that have occurred on the Prairies since 1974 is that at any given time only 20% of its fleet was optimal (presumably this being the most recent additions). As the Prairies have experienced the most frequent and most significant regulatory change over the past decade, it is not surprising that the following examples are from these provinces:

i. A tank operator in Saskatchewan used to purchase its tanks so that they would weigh-out on gasoline (ie, large enough tanks to take the full weight-load of gasoline allowed under the GVW limits). However, a series of adjustments in the allowable limits meant that the carrier was always facing a situation where some of its tanks were too small. The company now buys larger tanks than necessary, in anticipation of regulatory change, with the result that under the current regulations they are hauling more tare weight than necessary and less payload than possible. These larger-than-necessary tanks also cost more than the (currently) optimal ones.

ii. An Alberta trailer manufacturer points out that propane and anhydrous tanks were traditionally built with 90" diameters -- this being considered an optimal design. The increase in allowable GVWs, but the presence of the 16.75 kingpin-to-rear limit, has meant the abandonment of this optimal design. Apparently, to take advantage of the available GVW, more cube is required than can be accommodated in a 90" diameter tank within the 16.75 limit (ie, the tank is too short). The current tanks suffer from a higher (than optimal) tare weight because of this problem.

2.6 THE IMPACT OF REGULATIONS GIVEN ENFORCEMENT CONSIDERATIONS

The relationship between VWD regulations and fleets cannot be fully understood without considering the method and/or vigour of enforcement practices. Examples of where this is important:

i. One person claimed that Ontario would not now have such a variety of combination types (ie, axle types and/or arrangements) if the axle-load provisions of the regulations had been enforced when the bridge formula was first introduced (early 1970s). Ontario's concentration on (primarily) GVW after the adoption of the bridge formula stimulated the development and extensive use of a wide variety of belly axle arrangements. While aspects of this claim cannot be substantiated (ie, the enforcement or non-enforcement of axle loads in the early 1970s), it can be noted that Ontario carriers in high weight operations (eg, gravel) still experience difficulty complying with the axle-load/spacing provisions of the Ontario Bridge Formula.*

ii. Interviews with the manufacturers and users of hopper-bottom grain and fertilizer equipment in Western Canada indicate that there are difficulties in designing and loading 7-axle B-trains (3-S2-S2): in particular there are substantial difficulties distributing loads in a manner ensuring compliance with axle-load limits on the centre tandems. This problem has discouraged the use of B-train hopper-bottom units in Manitoba and Saskatchewan where axle loads are relatively strictly enforced. These same sources note that B-train hopper-bottom units are more common in Alberta; one of the reasons being the (reportedly) more lenient approach taken on axle-load enforcement.

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* *There may be some reservations about this claim. While truckers in Ontario often have axle-overload problems -- see Section 4.13 for a graphic exemple of a carrier (or trailer manufacturer) who has not mastered the intricacies of the Bridge Formula -- it also has to be borne in mind that (a) truckers in most provinces have axle overload problems -- including Atlantic Canada where the axle-spacing provisions are simple; and(b) the apparent enforcement of axle loads in Ontario today hardly appears to be slowing down the experimentation with various axle arrangements.*

iii. In one of the clearest instances of how an enforcement agency can influence fleet selection, one of the carriers interviewed is operating C-trains on its Ontario-to-Western Canada hauls. The carrier claims that Saskatchewan officials told him he had to use a C-train configuration for his doubles. It is believed, however, that this is really a case of confused messages -- however, confusion or not, the point here is that this belief on the part of the carrier is the reason for the acquisition of C-trains.

iv. Several carriers from Atlantic Canada indicated they had problems meeting the 21 m length limit when owner-operators with long wheel-base tractors hooked up to 48' semitrailers.* Some indicated that this was not an important issue as enforcement of the length limit in these situations (ie, long wheelbase tractors) was "soft."

v. A carrier from Western Canada noted that enforcement agencies were allowing him to operate some doubles exceeding by a small margin the 16.75 kingpin-to-rear restriction. At the same time another carrier from Western Canada has been obliged to cut 6" off its trailers because they exceeded the 16.75 m limit. The interesting point about this second situation is that: (a) the carrier had been operating the doubles for some time before the enforcement agencies noticed the violation; and (b) there may have been a possibility that some of the provinces involved were prepared to issue special permits to handle this case.

vi. Many of the carriers interviewed noted that there was a segment of the trucking industry that regularly operated outside of the VWD regulations -- three main violations generally being cited: axle overloads, GVW overloads, and length violations. There are, these carriers noted, many ways of avoiding detection (ie, alternative routes, alternative times, sliding fifth wheels, etc.). While any regulatory system will have some degree of non-compliance, there is a feeling among those interviewed that VWD regulations in particular were only loosely enforced, or, to state this another way, that VWD regulations were relatively easy to avoid if one wanted to do so.

vii. A carrier from Atlantic Canada that bought a trailer with inappropriate axle spacings does not appear to have to worry about the consequences: the enforcement agencies, who are apparently aware of the problem, have so far ignored the non-compliance.

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* *A tractor with a 30" front overhang, a zero fifth wheel offset, and a 48' semitrailer with a 30" kingpin setback exceeds 21 m when the wheelbase is 250" or more. Positive fifth wheel offsets and smaller kingpin settings reduce the critical wheelbase length.*

viii. Two carriers raised an interesting issue that may affect (to a small degree) the choice between moving freight in a van versus a container. Apparently, in some instances, enforcement agencies have decided that a container is an *indivisible load* -- the key to acquiring an overload permit. Most freight in a van, however, is clearly divisible and, hence, is obliged to move at the ordinary axle/GVW limits.

Finally, one last enforcement topic raised by almost all the people interviewed concerns axle loads. There were many complaints -- "the highway scales are inconsistent", "loads shift", "moisture contents vary from load to load", "the shippers control the load", etc. The issue as to whether or not there are problems with the enforcement system's handling of axle loads cannot be fully dealt with here. Rather, there appear to be three points that have to be noted:

i. Does this "problem" with axle overloads affect the choices made with respect to fleets? The answer is clearly **"yes"** as is evident by such things as (a) the use sliding fifth wheels to control the load distribution between steering and drive axles, (b) the case of one Ontario carrier who switched from using super single tires (apparently the carrier was overloaded on some axles for some trips, so it switched back to dual tires), (c) those carriers who are using more axles or more-closely spaced axles than are really necessary in some situations because they may occasionally have a problem with axle overloads, or (d) the previously-mentioned case of the choice between B-train or A-train dry-bulk hopper-bottoms on the Prairies (B-trains are avoided if there is strict enforcement of axle loads).

ii. Does this "problem" with axle overloads suggest that some regulatory systems are better or worse than others? The answer appears to be "yes" in the sense that the simpler the approach taken in the regulations, the fewer problems -- but having given this tentative **"yes"** it must be emphasized that this is a partial view of the whole system (there may be other factors over-riding this).*

iii. Is the "problem" with axle overloads affecting trucking? Again the answer has to be **"yes"** as it is quite evident from the case studies that concerns about axle overloads affect both equipment costs (some cases), operating costs (some cases), or competitive conditions (ie, the situation of the carrier who tries to comply with the regulations versus the alleged operators who do not comply).

2.7 THE IMPACT OF OTHER FACTORS ON FLEET SELECTION

In this section, the impact of non-VWD factors in fleet selection is considered; as in the preceding two sections, all that is attempted is a listing of scattered observations on these topics.

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* *In passing, it may be noted that at least one province appears to have deliberately adopted this "simple-is-better" approach. In Quebec, gravel (and other similar) trucks are exempted from the spread requirements of tandem and triple axles.*

2.7.1 Freight Characteristics

Freight characteristics are important in fleet selection. Some of these, such as dry bulk versus liquids versus general freight are so obvious in the choice of trailer types (dumps, hoppers, tanks, flatdecks, vans, etc.) that they can be ignored here. Other freight characteristics are a little less obvious in terms of how they affect fleet selection in terms of the main VWD regulatory elements (height, width, length, combination type, tires and tire loads, axle types and axle loads, GVW):

i. Several people interviewed noted that their trailer dimensions (height, width, length) were strongly influenced by the common 8' lengths used in several industries (primarily construction). So, for example, one carrier might prefer tractor-semitrailers over double 27' pups because the space lost on the pups when loading 8' material meant in fact that the pups offered no more space than the semitrailers. That is, the apparent 54' available on double 27's pups may be no more than the 45' or 48' available on semitrailers.

ii. Several carriers noted how palletized freight influenced their choice of equipment; the choices as to the type of equipment, however, differed among the carriers. One Western carrier claimed that pallet sizes were constraining his adoption of either doubled 27' of 48' configurations.[*]

iii. Some carriers suggested that TL general freight was not suited to double-trailer configurations; whereas several others suggested that LTL general freight was (both groups were thinking of double 27' or 27' + 28' configurations -- not the special permit doubles). Also, in terms of LTL freight and the use of doubles, most of the carriers interviewed felt that B-trains were not suited to LTL operations (difficult to unload the lead semitrailer, impossibility of mixing lead with rear pups, etc.),

iv. An Eastern carrier, hauling mainly refrigerated commodities, feels that doubles are not advisable with reefer vans: the cost of the reefers (roughly $20,000) doubles, and the possibility that one of the reefers breaks down also doubles. (However this opinion is not apparently shared by all carriers, as at least one of the interviewed carriers from Western Canada has used double-reefer units -- admittedly in a regulatory environment where the use of doubles is more compelling than in Eastern Canada.)

2.7.2 Terminal Characteristics

Terminal characteristics were cited as reason for selecting certain types of equipment in several of the case studies. Examples include:

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[*] *A certain number of standard pallets fit with the (previous) standard 45' van. The addition of 3' (the new 48' standard) is of no use with a 48" pallet. However, some industries have found ways around this, possibly by using different sized pallets, or by arranging them differently.*

i. Two private carriers interviewed (beer) indicated that they were not using doubles as the retail stores they delivered to could not handle such configurations. Although not interviewed, it is known that at least one beer company is using a limited number of doubles in some situations with a load-through method of handling the doubles at the retail outlets.

ii. One of the freight carriers interviewed that uses dromes had to redesign its main terminal before the operation was feasible: the tractors back up to docks where the tandem-drive axles fit right underneath, thereby permitting direct axcess to the drome.

iii. Some carriers report that they have not switched to doubles because of resistance from their customers: doubles increase the number of doors required at terminals.

2.7.3 Route Characteristics

Route characteristics, such as the length of the haul, the type of highway, the geographic characteristics (rural, intercity, mountainous, urban) and the nature of the haul (peddle, point-to-point) affect fleet selection. Examples mentioned in the interviews are:

i. A gravel hauler in Atlantic Canada noted that he uses 3-S2's on the very short hauls: it was not worth it, the carrier claimed, to use 3-S3's on this work.

ii. A tank truck operator in B.C., using several type of configurations including large B-trains (Table 2.2.1), uses smaller and, all other things equal, less efficient 3-S3's on deliveries where mountainous roads are involved. Apparently, given available tractors, the carrier can complete the route with the 3-S3 so much faster in comparison to the B-train that he feels he can compensate for the disadvantage of the smaller payload (47,000 versus approximately 58,000 litres).

iii. A Western general freight carrier noted that doubles were only worth while on the long hauls. Apparently the time and trouble it takes to handle doubles at the terminal (loading, unloading, assembling, dis-assembling) makes tractor-semitrailers more efficient on these shorter runs.

iv. A milk hauler in Ontario selects either A-trains or truck-plus-trailer configurations but not B-trains because of the nature of its routes. On the pickups (farms), the carrier needs relatively small tank trucks and/or tractor-semitrailers; on the linehaul, the carrier needs as large a unit as allowed under the regulations; and on the deliveries to dairies the carrier sometimes needs a unit that can drop a pup at one dairy while taking another load to another dairy. B-trains are not suitable for this constant process of assembling and dis-assembling, nor are they suitable where the lead trailer has to be used as a single unit.

2.7.4 End-point Characteristics

In several cases, the choice of equipment and/or axle types is constrained by the characteristics of the end-point:

i. Two milk haulers indicated that they use straight trucks for some of their farm pickups, even though a tractor-semitrailer might be preferable. The constraint in both cases was the size of some of the farmer's yards. One of these carriers also pointed out that although he would prefer wider tandems (and higher axle loads), he had to use 48" tandems because of the damage anything wider would do to the farmer's yard.

ii. With respect to the issue of wide-spread versus standard tandems, the same point noted by the milk haulers was mentioned by some of the petroleum haulers in Ontario: widespread tandems can damage some yards at retail outlets.

iii. A brick hauler in Ontario uses a truck-plus-trailer configuration because of the maneuverability of such a unit at construction sites. The trailer can easily be unhooked, allowing the truck to enter the site to make a delivery. After transferring the load from the trailer to the truck, the truck re-enters the construction site to complete the delivery. In British Columbia, it appears that this same rationale is used by most of the gravel (aggregate) haulers; they also tend to select truck-plus-trailer configurations. *(See Section 7.5.3 for a description as to how these units manage to transfer loads from the trailer to the truck.)*

iv. Several carriers noted that the amount of turning space at shipper's or consignee's terminals was preventing them from switching to doubles. In fact, some report that shippers have strongly discouraged the carrier's use of doubles because of the difficulty of handling them within confined areas.

2.7.5 Vehicle Characteristics

The following comments show how vehicle characteristics interact with VWD regulations to affect fleet choice:

i. **Forty-eight Foot Trailers:** A Western carrier is purchasing 48' semitrailers not because he really needs them (ie, he can weigh-out on 45') but rather because the difference in purchase price between a 45' and a 48' is very small and the carrier believes the 48' semitrailers will have a higher resale value a few years down the road. A houshold goods carrier, using specialized trailers, noted that the difference in price between a 45' and a 48' semitrailer was US$ 234.

ii. **Axle Spreads:** Many carriers interviewed suggested that there was a trade-off between the higher loads allowed (in some provinces) with wide-spread tandems and the extra costs associated with these tandems. It is understood that, for example, a 72" tandem costs a few hundred dollars more than the 48", it adds to tare weight, and it increases tire wear. One carrier from Western Canada tried 72" tandems, but has since abandoned them because of the problems with "ploughing" and steering. Another issue involving axle spreads concerns triple and/or tri-axles: a carrier from Atlantic Canada noted that evenly spread 3-axle groups (8' plus 8') are preferred in bulk commodity movements where the distribution of the load over the three axles is critical; the uneven 6' plus 10' spread is preferred because of its turning ability (this second 3-axle group has a liftable axle).

iii. **Four Axle versus 3-axle Trailers:** An Ontario carrier uses 8-axle configurations (truck-plus-trailer) because he feels the 4-axle trailer is safer (sways less, more brakes) and handles easier (backing up) than the 3-axle trailers. For all practical purposes, the carrier gains no payload by using 8-axle equipment rather than 7-axle; in fact, there is a slight tare-weight disadvantage to using the eighth axle. In a completely different regulatory environment on the Prairies, one trailer manufacturer actually refuses to fill requests for 4-axle trailers (on the Prairies, short of a special permit, these could only be hauled behind a 3-axle truck). The manufacturer's rationale is that 3-4 units are not "appropriate" -- presumably because of the weight of the towed unit in relation to the weight of the truck.

iv. **A-versus B-trains:** A great many opinions on the relative advantages of A- or B-trains were received*; it is difficult to either summarize these (given the conflicting views) or do justice to them (given the number). Ignoring those opinions that involve the use of one type of train or the other because of terminal, route, end-point, shipper, or industry characteristics, and ignoring those situations were the use of one type of train or the other were selected because of the impact of regulations (eg, Manitoba favoring A-trains, the influence of U.S. regulations, enforcement considerations, changes over time, etc.), the following appear to be situations ("opinions") where various characteristics of the trains were important in influencing the choice of configurations: (a) the relative stability of B-trains; (b) B-trains have an advantage in that the division of the load between the lead and second pups is not as critical as it is on A-trains (apparently because of the weight transfer with B-trains); (c) the heavier tare weight of B-trains, according to some, is a disadvantage in comparison with the A-train (there were contrary opinions); and (d) the difficulty of mixing lead with rear pups in B-trains.

v. **Short Pups:** One carrier feels that pup trailers of 20' or less are not stable; some loads, such as lumber, bounce around on short pups. This view was echoed by one tank manufacturer that claimed short pups have a tendency to roll.

vi. **Doubles versus Tractor-Semitrailers:** Some of the advantages and/or disadvantages of doubles have already been noted with respect to freight characteristics (eg, TL freight or refrigerated freight), terminal characteristics, and route characteristics (eg, short hauls or mountainous terrain). In addition to these considerations, there are a few others that relate to opinions and/or perceptions about combination. A carrier from Western Canada noted that a double set costs twice as much as a single: that is, for a gain of roughly 12.5% in cube (54/48) -- and this ignores any cube lost because of loading problems in doubles -- equipment costs double. Several carriers mentioned that the apparent cube advantage of a double (say 2 X 27') over a single (48') is not as great as the figures 54:48 suggest: in many applications the double 27' pups will lose a certain amount of loading space (2-3' per pup), reducing the available cube to not much more than that available in a 48' semitrailer. One carrier from British Columbia noted that if and when the current prohibition on 3-axle groups on 48' semitrailers is lifted they would consider reducing the number of doubles they operate (a 3-S3 can potentially, but rarely practically, register at 52,200 kg versus a double's 63,500 kg).

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* *Too few C-trains were seen or discussed to be added to this discussion.*

vii. **Truck-plus-Trailers:** The major disadvantage of this combination, according to several of the people interviewed, is the down time associated with periodic maintenance requirements. Unlike a tractor-semitrailer, when a truck is down, the freight-carrying vehicle is also down.

viii. **Long-Wheelbase Tractors:** Some of the regulatory issues involve the use of long-wheelbase tractors (eg, problems in some provinces meeting overall length restrictions when such tractors are used). Although the pros and cons of various types of tractors are not fully known, one carrier suggested that the preference for long-wheelbase tractors was connected with (a) lower maintenance cost, (b) greater stability, (c) better aerodynamics, and (d) driver comfort ("better ride").

2.7.6 Shipper Characteristics

Little is known about the importance of shipper characteristics in influencing the fleet selection of for-hire carriers. The following is the only comment on the subject picked up during the interviews:

i. One Manitoba-based general freight carrier is using primarily 45' vans (instead of 48') primarily because its shippers "think" in terms of shipping in quantities that just fill such a trailer.

2.7.7 Industry Characteristics

In some instances industry characteristics played a role in determining aspects of fleets (these can be for-hire truck industry characteristics, private carrier or shipper characteristics, and in one case, trailer manufacturer characteristics and/or attributes):

i. A private carrier in Atlantic Canada ships mainly on 3-S2's even though it could increase payloads by (a reported) 21,504 lbs. by switching to 3-S3's. The reason for this use of 3-S2's is the shipper's use of owner-operators and the method used to pay owner-operators. Apparently, there is no incentive in this payment schedule that encourages owner-operators to switch to 3-axle semitrailers. (Presumably this can happen where owner-operators are (a) paid so much a load irrespective of the size, or (b) paid so much a mile, or (c) paid on a cwt. basis where the scale is such that the higher revenues earned on larger loads do not off-set the extra costs).

ii. Several of the people interviewed indicated that some of the configurations being used were justified, among other things, because the "drivers were used to or preferred that type of equipment." Examples of the type of equipment being operated under this justification included the use of long wheelbase tractors, the use of conventional tractors instead of COE's, the use of 3-S2's instead of 3-S3's, etc.

iii. One person was of the view that one of the reasons explaining the relative popularity of B-trains in Alberta in comparison to their popularity in Saskatchewan (Saskatchewan and Alberta have quite similar regulations) is the promotion on the part of trailer manufacturers. In other words, some of the manufacturers in Alberta promoted B-trains heavily after they first appeared, and this has been significant enough to account for their relatively high use in Alberta (see Background Paper #4 for numbers).

iv. There are several reasons why the household goods moving industry has not switched to doubles. One of these concerns the manner in which the industry is organized. Briefly, because owner-operators handle most of the interprovincial shipments and because these individuals are responsible for the load, it is not feasible to use a combination (such as a double) where some of the shipments would be out of the control of the driver (ie, in the case of a double, the driver would have to dis-assemble his vehicle prior to entering residential areas and leave it with some other agency for unloading or furtherance.)

2.8 SUMMARY

While the information gathered as a result of the case studies is not sufficient to develop the definitive model of how choices about fleets are made in the real world, it is valuable in providing some insights to the process. Vehicle weight and dimension regulations exercise a controlling influence over the trucks on the road. But to understand how they really work, they have to be seen within the following context:

Select a Vehicle Configuration, given:

1) **VWD Regulations**
Jurisdiction A - multiple layers
Jurisdiction B - differences within regions
- differences between regions
U.S. Regulations - differences between Canada/U.S.
- indirect impact of U.S. regulations

2) **Changes over Time**
   - how fast to respond?
   - expect future changes?
   - change large enough to change fleets?
   - what to do with regulatory obselescence?

3) **Enforcement**
   - de facto versus de jure regulations
   - "overbuild" vehicles to avoid problems?
   - enforcement varies from place to place
   - compete with some who do not comply

4) **Non-VWD Factors**
   - freight characteristics
   - terminal characteristics
   - route characteristics
   - end-point characteristics
   - vehicle characteristics (incl. costs)
   - shipper characteristics
   - industry characteristics

The point to note about this is: there is no simple, one-to-one relationship between a set of weight and dimension regulations and a truck fleet.

3. Case Studies: New Brunswick

3.1 BROOKVILLE TRANSPORT LIMITED

3.1.1 Background

Brookville Transport Limited is a truckload operator based in Saint John. Most of the company's operations are between New Brunswick and the U.S., and the U.S. and Ontario.

The company has applied to regulatory boards in New Brunswick and Ontario for expanded general freight operating authority between New Brunswick and Ontario. If successful in obtaining these licenses, the company will significantly expand its opportunities for growth as well as improve its operating efficiency by completing the missing link (N.B.- Ontario) of its triangular operations.

Primary commodities transported by Brookville include beer from New Brunswick to the U.S., fresh fruit and vegetables from the U.S. and glass products.

3.1.2 Equipment/Operations

Brookville Transport presently owns 30 trailers including five flatbeds, five reefer-equipped tandem semitrailers and 20 tandem dry vans. The trailers are all 48 feet in length, 102 inches wide and all of the tandem-axles have 72 inch spreads. Leased tandem semitrailers are also used. Owner-operator tractors are used for almost all movements although the company does own five tractors.

Almost all of Brookville's present operations involve a portion of the freight movement over U.S. highways. Accordingly, equipment decisions are geared towards meeting the 80,000 pound GVW restrictions applicable to U.S. highways. As an example, one load of palletized beer yields a payload of approximately 47,400 pounds. A typical tractor has a tare weight of 18,000 pounds and a semitrailer has a tare-weight of 13,000 pounds. Under these conditions the total GVW would be 78,400 pounds.

The strategy of the company has been to find the lightest possible tractors and semitrailers so that the greatest possible payload could be realized within the 80,000 pound limit.

If the company is successful in obtaining licenses in the New Brunswick-Ontario lane, purchase of tri-axle equipment is likely within the foreseeable future to take advantage of the higher GVW limits available on this lane in comparison with the U.S. It was emphasized, however, that the tandem-axle semitrailer would likely continue to play a prominent role in the fleet because of the company's extensive involvement in transborder operations.

3.1.3 Existing VWD Regulations - Issues

Because of the nature of Brookville's business, Canadian VWD regulations are not presently an important operational factor.

This case study is probably representative of many companies which are extensively involved in trucking of freight to/from the U.S. The management seems to be almost totally unconcerned about Canadian VWD regulations. This will likely change somewhat as the company expands its activity in the New Brunswick-Ontario lane. Indeed, this will pose an interesting operational problem for the company. As noted above, one of the primary reasons for applying for expanded operating authority in the New Brunswick-Ontario lane is to complete the third leg of the company's triangle. The objective is to have two options at each point of the triangle. For example, a truck arriving in Ontario with a load from New Brunswick would have the option to return to New Brunswick or proceed to the U.S. depending upon the availability of traffic. Clearly tradeoffs will have to be made between the productivity gains to be realized from a tri-axle in the New Brunswick-Ontario lane versus the productivity penalties which would be suffered from operating a tri-axle with the extra tare weight of the third axle in the U.S. lanes.

3.2 BRUNSWICK PETROLEUM TRANSPORT LTD.

3.2.1 Background

Brunswick Petroleum is a truckload operator based in Saint John, hauling primarily dry and liquid bulk commodities throughout the Maritimes and United States. Major commodities include petroleum, fish oil, dry and liquid chemicals and paper rolls.

3.2.2 Equipment/Operations

Brunswick Petroleum owns 35 tractors and 75 trailers. Six of the semitrailers are 45 feet in length and are used primarily for delivering petroleum products to service stations.

The company owns eight 7-axle B-train configurations which are used in the transport of kraft paper from the Nackawic Pulp and Paper Mill in Nackawic, N.B., to the Port of Saint John.

Sixty semitrailers are equipped with three axles with two different axle spread configurations. Six have an overall spread of 16 feet with spreads between axles of 6 and 10 feet. Two have equalized loading of the axles and are used for hauling petroleum. The other four do not have equalized loading and are used for hauling paper products. The remaining 54 tri-axle semitrailers have even spacing of 8 and 8 feet between axles. Again a mixture of semi-trailers with equalized axle loading (15 units) and non-equalized loading (39 units) exists. All three-axle units have the capability of lifting the first axle in the configuration. The interviewee commented that although the 6 and 10 ft. configuration allows for better turning capability, the 8 and 8 ft. configuration is much better in terms of obtaining the required weight distribution over the axles. This is a critical factor in bulk commodity movements.

3.2.3 Existing VWD Regulations - Issues

Compliance with axle load restrictions is a major problem for this operator. This is particularly difficult when hauling liquid bulk commodities which tend to move around in the tank, especially when the tank is not fully loaded. The normal practice at the highway scales is to weigh the axle loads four or five times. Despite this procedure, it is not uncommon to be 4,000 kg under GVW but overloaded on the axles.

The interviewee also noted a problem with inconsistency in highway scales with respect to weight measurement. He stated that his company frequently experiences situations in which a full tank load of a particular commodity may be under allowable GVW on one trip and yet be overweight on a truck load of the same commodity on another trip. He stated that these are not just isolated occurrences, but rather frequent in nature.

3.3. DAY & ROSS LTD.

3.3.1 Background

Day & Ross Ltd. is a large, primarily LTL general freight carrier with extensive operating authority throughout Canada and the U.S. A large proportion of its activity is in Eastern Canada and the New England states.

Day & Ross employs approximately 240 owner-operators who supply a large fraction of the company's total motive power.

3.3.2 Equipment/Operations

Day & Ross currently owns approximately 90 tractors and 928 trailers. Approximately 500 of the semitrailers are reefer-equipped dry vans of which 400 are tandems and 100 are tri-axles. The company owns 62 flatbeds of which 30 are tri-axles and 32 are tandems. The company also owns eight sets of A-trains.

Almost all of the company's tri-axles have a lift axle with 6 and 10 foot spacing between the axles. The tandems have 72 inch spacing.

Approximately one-third of the semitrailers are 48 feet in length with the remainder being 45 feet in length. Day & Ross has recently ordered 42 new semitrailers all of which will be 48 feet in length. Although the new semitrailers will have tandem-axles, their frames will be such that the axle configuration can be easily converted to tri-axle as the need arises.

The tri-axle equipment is used extensively in the Maritimes to Quebec/Ontario lane. Much of the freight hauled for McCain Foods, an affiliated company, is transported in reefer-equipped tri-axle equipment.

The tri-axles are not widely used in hauling LTL freight. A tandem-axle semitrailer can almost always provide sufficient weight payload capacity on LTL head hauls. The tandems are also used in all U.S. operations because of the U.S. 80,000 pound GVW restriction.

The eight sets of A-trains are used primarily between Montreal, Toronto and Winnipeg. When operating in New Brunswick, these A-trains operate under a special permit. These configurations are well suited to courier operations because of the quicker unloading and loading that is possible. They also provide for a heavier GVW on truckload back hauls. On the negative side, Day & Ross experiences considerable difficulty with lights and braking due to the extra hook-up.

The fleet also includes eight drop-frame vans which provide more cubic capacity than a conventional semitrailer (total of 4,000 cubic feet).

The company depreciates its trailers over eight years for accounting purposes. However, it is their policy to operate all trailers until it is no longer economic to maintain them. It is not uncommon to obtain a 15 year physical life from this equipment.

The interviewee commented that equipment suppliers have limited influence on equipment purchase decisions in terms of the actual configuration of the equipment. The specifications are normally provided by the operator. The interviewee also commented that he is somewhat disappointed by equipment suppliers with respect to the progress they are making in improving trucking equipment. He commented that aerodynamic features are still not adequate. Another major objective for operators is to achieve a lower tare weight for trailers for a given capacity. Day & Ross would like to see further progress made in the use of lighter weight structural material for both tractors and trailers without compromising the structural integrity of the equipment.

3.3.3 Existing VWD Regulations - Issues

Day & Ross has difficulty on occasion complying with the 21 metre overall length restriction on combinations. Whenever an owner-operator uses a long wheel base tractor (which is preferred by most owner-operators) the 21 metre limit is violated if the tractor is connected to a 48 foot (14.65 metre) semitrailer. The regulations are written such that both long wheel base tractors and 48 foot semitrailers are permitted. However, strickly speaking, the two should not be operated in combination. As noted above, Day & Ross relies extensively on owner-operators. The company has a policy that restricts brokers to a maximum tractor wheel base of 225 inches. However, some of them (8) are operating tractors with a 240 inch wheel base.

Regarding interprovincial operations, the following irritations were cited:

i. Day & Ross now operates extensively between Ontario and Winnipeg, Manitoba. The lower allowable GVW in Manitoba relative to Ontario restricts their weight capacity utilization in this lane.

ii. The interviewee also was critical of the inconsistency in spring weight restrictions between provinces, particularly the difference in approach between Quebec and New Brunswick. In Quebec, the percent reduction in allowable axle loads for tandems and triples is significantly more than the maximum reduction in New Brunswick which would be 20% of the normal allowable axle load.

iii. A comment was also made about the fact that Nova Scotia does not permit a load above 17,000 kilograms on any axle group on secondary highways. In effect, this means that the payload advantages of the tri-axle cannot be utilized on other than the primary highways. This observation was also made by another company (Kingsco) in the context of its salt hauling operations from Pugwash, Nova Scotia.

Unlike several other operators, Day & Ross does not perceive a major problem with respect to inconsistency between highway scales in terms of weight measurements. The interviewee commented that this is likely to be a more critical problem for smaller operators, particularly those who are involved in the haulage of heavy bulk commodities.

The one major change that Day & Ross would like to see in the existing VWD regulations is the legalization of Rocky Mountain doubles and double 48 foot trailers. According to the interviewee, Day & Ross has recently completed an impact assessment study of the potential for improving operating efficiency through the introduction of double 48 foot trailers. An immediate annual saving of $1,000,000 in operating costs could be realized. He added that the company does not see why the operation of such equipment would not be feasible on four lane highways. Annual savings of approximately $500,000 could result from the introduction of Rocky Mountain doubles on high traffic volume lanes. Double 48's provide greater operating flexibility in terms of being able to consolidate full loads to a given terminal (eg. from Moncton terminal, loading one trailer to be dropped at Fredericton, with the other continuing on to Hartland or Montreal).

3.4 DRURY'S TRANSFER LIMITED

3.4.1 Background

Drury's Transfer is a general freight LTL carrier operating exclusively within the province of New Brunswick. The company has five terminals throughout the province and 100 employees.

3.4.2 Equipment/Operations

Drury's fleet consists of 44 tractors and 110 trailers. One hundred of the trailers are dry vans, five are reefer-equipped and five have container chassis. The company also owns 16 straight trucks.

All of the company's trailers are equipped with tandem-axles with a 72 inch spread. Most of the semitrailers (approximately 95%) are 45 feet in length with the remainder being 40 feet in length. The company currently does not own any 48 foot semitrailers as this length was not permitted when the 45 foot equipment was purchased. Existing equipment will be replaced with 48 foot semitrailers as it reaches the end of its economic life.

The fleet does not include any tri-axle semitrailers because the density of the freight typically hauled is such that the weight payload advantages of the tri-axle are not generally needed.

3.4.3 Existing VWD Regulations - Issues

Management of Drury's Transfer do not perceive any major problems with the existing regulations. As noted above, weight capacity is not a problem because of the type of freight the company hauls. In essence, they have still not caught up with changes in the regulations because they still own only 45 and 40 foot semitrailers even though 48 foot semitrailers are permitted. Although cubic capacity is important to the company given the business that it is in, it is obvious that the benefits of moving to 48 foot equipment immediately do not outweigh the costs of premature retirement of existing equipment.

Spring weight restrictions do pose a slight operational problem on highways which are restricted to 80% of allowable GVW. The problem is most noticeable in northern New Brunswick and in particular with the services the company provides to Dominion Stores. However, for the most part, since Drury's trucks are generally cubing out before weighing out, the weight restriction resulting from spring weight restrictions is often negligible.

A minor irritation was noted with respect to the fact that axle loads are regulated in addition to GVW. Essentially, greater care must be taken in loading the trailers to ensure that the axles are not overloaded. The company finds it necessary to use two people to load the trailers and relatively close supervision. Although this was raised during the interview, it was not described as a major operational problem.

One major change in the existing VWD regulations which would benefit Drury's Transfer significantly would be the legalization of Rocky Mountain doubles. The president of the company expressed the view that this type of equipment would be well suited to their express operations. For example, they could load one trailer for Fredericton and another for western New Brunswick. The first trailer could then be dropped in Fredericton with the shorter trailer continuing on to western New Brunswick.

Drury's Transfer is probably representative of the many trucking companies in Canada who operate strictly within the boundaries of one province - ie. it does not appear to be unduly impacted by any constraints imposed by the VWD regulations. Indeed, other factors such as balancing traffic in lanes are having a greater bearing on operating efficiency than the equipment that is being used.

3.5 KINGSCO TRANSPORT LTD.

3.5.1 Background

Kingsco Transport Ltd. is an association of 32 independent truckers. The company itself does not have any assets as the trucking equipment is owned by the independents.

Kingsco operates primarily within New Brunswick but also has operations in Nova Scotia, P.E.I. and in Maine and New Hampshire in the U.S. The company's business is essentially the haulage of bulk commodities. In order of importance, the commodities hauled include salt, fertilizer, grain, sand and gravel.

3.5.2 Equipment/Operations

The Kingsco operators collectively own seven tractors, and 26 dump trailers. The trailers have a 36 foot chassis and a 33 foot box.

Seventeen of the trailers are tri-axle configurations with 16 foot overall spread and 6 foot spread between the second and third axle. Nine of the trailers are tandem dumps with 72 inch spread on the tandem axles. Some of the tri-axles have a lift axle.

The tandem trailers are generally used for smaller loads and on highways where the maximum GVW of the tri-axle is not achievable due to road class restrictions. Since this company hauls approximately one-half of the tonnage of salt used by the New Brunswick Department of Transportation, they operate frequently on roads which are restricted to a maximum GVW of 38,500 kilograms. Furthermore, the tri-axle offers no advantage for hauling salt from the mines in Pugwash, Nova Scotia, as this province does not permit loading of an axle group above 17,000 kilograms on secondary highways.

Many of the company's trailers were custom built by King Trailers in Toronto. The company does not perceive a need at this time to purchase larger equipment. However, they are looking seriously at purchasing a limited number of train configurations for lighter commodities which tend to cube out such as feed grains.

3.5.3 Existing VWD Regulations - Issues

Although the company does not have a problem operating within existing GVW limits, they do have considerable difficulty conforming to axle load restrictions. Considerable care has to be taken in loading bulk commodities on dump trailers such that the axle load restrictions are not exceeded. This takes extra time in loading. Furthermore, Kingsco operators have encountered considerable inconsistency in the weight measurements on the various highway weigh scales.

Another issue was raised with respect to front-axle loading. In order to achieve maximum GVW, the company often loads up to 14,000 pounds on the front axle using oversize tires. According to the interviewees, the heavy front-axle loads and oversize tires reduce steering and handling ability particularly when road conditions deteriorate during the winter. New Brunswick regulations permit up to 9,000 kilograms on the front axle provided axle ratings and tire load ratings are not exceeded. The maximum GVW restrictions are calculated based on 4,500 kilograms on the front axle. If the front steering axle is loaded above 4,500 kilograms, the additional weight can be added to the allowable GVW, provided that the maximum GVW for the class of highway is not exceeded. Hence, there is an incentive to increase weight on the front steering axle, particularly during periods of spring weight restrictions when all axles may be restricted up to 20% of their normal allowable load.

The spring weight restrictions have a significant impact on Kingsco operations, particularly since they operate on many roads subject to an 80% axle load restriction. Kingsco normally surcharges its customers during the spring weight restriction period. Generally, they share the cost penalty resulting from the restrictions on a 50-50 basis with the customer. It is not uncommon for Kingsco to be involved in a haul which, for example, would consist of a considerable distance on a 100% road followed by a further distance on a 90% restricted road and then perhaps a short distance (eg. 10 miles) on an 80% restricted road. Accordingly, the load for the entire trip may have to comply with the 80% restriction which applies only to a very small proportion of the total haul.

This case study illustrates some important influences that the vehicle weight and dimension regulations have on trucking operations. They are summarized below:

i. The best fit between Kingsco's business and the VWD regulations consists of a mixture of tandem and tri-axle equipment. This is in contrast to other cases where the best fit may involve only one type of equipment.

ii. In the opinion of the interviewee the regulations can create incentives to introduce operating practices which may be less than desirable. Undoubtedly, loading a front steering axle up to 9,000 kilograms is safe. However, under certain road conditions, it may not be as safe as a 4,500 kilogram front axle load.

iii. Axle load restrictions appear to be much more critical to the operator than GVW restrictions. Compliance with axle load restrictions is a problem because of the difficulty of distributing the load properly over the axles. It is possible to achieve higher GVW's without exceeding semitrailer axle load restrictions by adjusting the placement of the fifth wheel so as to increase loads on the axles of the tractor. However, this does not ensure compliance as it is very easy for operators to slide the fifth wheel back after they have crossed the highway scales.

iv. Spring weight restrictions clearly have a significant impact on both truckers and shippers. Undoubtedly, the ability of a trucker to pass the increased costs on to its customers is a function of the competitive environment. An important observation from this case study is that the operator perceived the restrictions in New Brunswick to be fair and reasonable. The method for imposing the restrictions is well known and operators can plan their spring operations in advance.

3.6 OLAND'S BREWEREY LIMITED

3.6.1 Background

Oland's Brewery Ltd. is one of two major New Brunswick based breweries located in Saint John. Oland's also has a plant in Halifax. Most of the beer produced in the Saint John plant is shipped to liquor stores in New Brunswick, Prince Edward Island and to a lesser extent in Nova Scotia and Newfoundland.

3.6.2 Equipment/Operations

Oland's relies exclusively on owner-operators for transport of their beer. The owner-operator fleet consists primarily of five-axle (3-S2) tractor-semitrailer configurations. Recently, some of the owner-operators have acquired tri-axle semitrailers. The productivity gains realized from the use of tri-axle versus tandem semitrailers for the transport of beer are substantial. Eighteen pallets can be loaded on a tandem for a total payload of 48,384 pounds (each pallet weighing 2688 pounds). Up to 26 pallets can be loaded on a tri-axle for a total payload of 69,888 pounds. This represents a 33% increase in payload. More importantly, it means that, as a rule, three liquor stores can be serviced with one truck as opposed to two stores with a tandem trailer load. Since beer movements are uni-directional, the tri-axle contributes towards a reduction in empty miles.

It is interesting that despite the productivity advantages of the tri-axle for transportation of this commodity, the tandem semitrailer continues to handle a large fraction of the total movements. Two major reasons were cited:

i. Rates paid to owner-operators are still based on a 40,000 pound load and have not been adjusted to reflect the productivity advantages of the tri-axle, and

ii. The owner-operators cannot afford to replace the tandem trailers with tri-axles until they have reached the end of their economic life.

A further consideration is that Oland's appears to have a policy of maintaining loyalty to its owner-operators. The option of replacing existing owner-operators with others who operate tri-axle equipment was not considered to be viable by the interviewee.

When queried about the potential application of train configurations for the movement of beer, the interviewee responded that such equipment would only be appropriate for movement of beer from the Saint John plant to the Halifax plant and vice-versa when market conditions create temporary imbalances in supply and demand.

3.6.3 Existing VWD Regulations - Issues

The interviewee felt that the existing regulations do not pose any severe constraints relative to the efficient transportation of beer. The primary goal at this stage seems to be to move towards a greater proportion of tri-axle transportation than currently exists. As described above, this is essentially an internal company problem.

The spring weight restrictions do impose a significant penalty, particularly when the highway is restricted to 80% of normal allowable GVW. An 80% restriction translates into a reduction of three pallets on each load. This means that for a tandem semitrailer which holds 18 pallets, seven trips are required to haul the same amount of weight that could be hauled in six trips during normal operating conditions.

An interesting feature of this case study is that the operational efficiency of this company's trucking operations seems to be affected more by company operating policy at the present time than by the VWD regulations. The policy of relying totally on owner-operator equipment, both tractors and semitrailers, combined with the policy of basing rates on 40,000 pound loads, appear to be preventing the company from realizing maximum operating efficiency. The VWD regulations do not appear to pose any major productivity constraints for this company. On the contrary, there appears to be ample opportunity to improve productivity significantly within the existing regulations. The interesting question posed by this case study is "*How many companies are failing to take full advantage of the regulations?*" Is this company atypical? Are companies that rely extensively on owner-operators more susceptible to sub-optimal equipment configurations than companies who own their equipment, particularly their own trailers?

3.7 R AND G MILK TRUCKING LTD.

3.7.1 Background

R and G Milk Trucking Ltd. is a wholly-owned subsidiary of the New Brunswick Milk Marketing Board, an organization which oversees the production and processing of milk in the province of New Brunswick. R and G is one of many trucking companies involved in the transportation of milk from producers to five processors located within the province.

3.7.2 Equipment/Operations

R and G owns eight tractors which have a 195 inch wheelbase and normally operate with 12,000 pounds on the front axle and 38,000 on tire tandem rear axles. The company also owns four tandem-axle straight trucks which have a 270 inch wheel base and are equipped with a tank which will hold 14,000-15,000 litres of milk.

The company owns six tandem-axle semitrailers, five of which have a 72 inch spread and the other having a 60 inch spread (this was purchased second-hand). They are 36 feet in length and have a capacity of 25,000 litres of milk.

R and G also owns four tri-axle semitrailers of which two have a 16 ft. overall spread with 6 and 10 ft. spreads between the axles. One of the tri-axles has a 13 ft. overall spread with 5 and 8 foot spread between the axles. The other has an 8 ft. overall spread with 4 ft. spreads between each axle. The tri-axles are either 39 feet or 42 feet in length with a capacity of 28,000-32,800 litres depending on the length.

The straight trucks are used primarily on short hauls where the volume of milk in a given territory is not sufficient for the use of the larger semitrailers. They are also used where accessibility to farms is a problem. The Milk Marketing Board has adopted a farmyard policy aimed at improving accessibility so that eventually all farms will be able to accommodate semitrailers.

Peaking characteristics of milk production play an important role in the usage of tandem-axle versus tri-axle semitrailer equipment. Peak milk production occurs during the months April through July. October, November and December are the low production months. As an example, during the low production period, a tandem-axle semitrailer with 25,000 litre capacity might be used to service 16-18 farms. During the month of June, when production quotas increase, the same farms would be served by a 30,000 litre tri-axle. The tri-axles are also used extensively on long hauls, particularly in northwestern New Brunswick.

R and G's operating strategy is to act as a buffer in the overall transportation system. The objective is to maximize the efficiency of the other truckers who are involved in the transportation of milk. R and G absorbs all of the inefficient operations so that they can "manage the inefficiency". Hence in addition to such factors as farm size, farm location, time constraints, density of farms, etc., R and G has to ensure that the extent of its involvement in trucking of milk is not disruptive to the other truckers.

The interviewee pointed out that other factors such as cleanliness standards and "soft" management issues affect equipment utilization. For example, "pump-overs" whereby milk from smaller trucks is pumped into a larger tanker can only take place at locations where tank washing facilities are available because the cleanliness standards require that the small trucks be washed immediately after pumping out. An example of "soft" management considerations is a situation whereby a given driver is accustomed to hauling a particular piece of equipment (say a tri-axle). While there may be some operating efficiency gains in setting up trailer relays, the pride that a driver takes in a particular piece of equipment is also significant given the crucial importance of cleanliness.

The life cycle of a tank is approximately 5-6 years. R and G normally rebuilds them once and then trades them at the end of the second life cycle.

The company is not yet involved in train operations. However, if the predicted consolidation of dairy processors occurs, train equipment will likely be purchased because larger volumes of milk will be moving over longer distances.

3.7.3 Existing VWD Regulations - Issues

R and G is largely unaffected by non-uniformity in provincial VWD regulations because at the present time New Brunswick milk production is essentially balanced to meet the needs of the province. Currently only about 2% of New Brunswick's volume of milk production is transported to other provinces.

Two of the four tri-axle semitrailers were purchased from a supplier in the province of Quebec. These tri-axles do not have the minimum spacing of 14 feet from the tandem-axle on the tractor to the first lift-axle on the tri-axle. Accordingly, they are technically not tri-axles under the New Brunswick regulations. Hence, if these standard trailers were to be converted to a configuration legal in New Brunswick, both the length of the trailer and the diameter of the milk tank would have to be altered resulting in substantial additional costs. Hence, from R and G's point of view this non-uniformity in the regulations is very bothersome. They are operating the two semitrailers as tri-axles even though, strictly speaking, they do not qualify as such.

During spring weight restriction periods R and G attempts to maximize the load on the front steering axle in order to increase payload. For example, if the front-axle load can be increased from the normal operating load of 12,000 pounds up to 20,000 pounds, this translates into an equivalent volume of milk of 3,600 litres. R and G has never encountered any spindle or tire failures due to heavy loads on the front axle. According to the interviewee, trailer and tank specifications are extremely critical in terms of being able to get sufficient weight on the front-axle.

During the spring weight restriction period tri-axles are used to the maximum extent possible in order to increase payload. During these periods loading begins at farms furthest from non-restricted highways. Once the tri-axle is fully loaded it is usually very close to a non-restricted road. R and G used to apply for special permits during spring weight restrictions when the restrictions were as low as 60% of normal allowable GVW. However, the company does not find this necessary under the present 80% and 90% restrictions.

The interviewee stated that R and G does not have a problem with respect to a high centre of gravity on the milk tanks. He did note however that, although the tanks are stable when loaded, they can become very unstable when two-thirds loaded because of the sloshing of milk in the tank. R and G has had one tanker rollover at an interchange due to this problem.

This case illustrates that the VWD regulations are but one of a myriad of factors which affect the productivity and efficiency of trucking operations. The regulations have a major impact on equipping strategy. Once the equipment is purchased, the objective becomes one of optimizing its use taking into account a number of factors, many of which are conflicting.

The problem of the inadequate spacing between the tandem-axle on the tractor and the first-axle of the tri-axle is interesting in the sense that this non-uniformity between Quebec and New Brunswick regulations can have significant implications for equipment costs. According to the interviewee this problem is also quite common with dump trucks. It is probable that standard equipment configurations manufactured in one province may be heavily influenced by the regulations of that province. Hence operators from other provinces who purchase this equipment may be at a significant disadvantage.

3.8 RS COUGHLAN LTD.

3.8.1 Background

RS Coughlan Ltd. is a small truckload carrier with operating authority in New Brunswick and in 48 states in the United States. The major commodities hauled by this carrier include lumber, peat moss, sand and gravel, machinery and salt.

3.8.2 Equipment/Operations

RS Coughlan owns ten tractors, one 4-axle straight truck and 32 semitrailers. The semitrailer fleet consists of three dump trailers, 13 vans, 12 flatbeds, three floats and one other general-purpose trailer.

The 13 vans have tandem-axles with 72 inch spread and consist of a mixture of 45 foot and 48 foot lengths.

The 12 flatbeds consist of 11 tandem-axles with 72 inch spread and one tri-axle with 16 foot overall spread and 6 and 10 ft. spreads between axles. Six of the 12 flatbeds are 45 feet long, four are 40 feet long and two are 42 feet long.

The three floats consist of one close-spread triple-axle with 48 inch spread between the axles and 2 tandem-axle floats with 48 inch spread. The float equipment was bought second-hand and is adequate for hauling light equipment such as tractors, skidders, etc.

The 40 foot equipment is well suited to hauling lumber and building products which tend to be in eight foot lengths. The company plans to stretch two of its 40 foot trailers to a 45 foot length. The 45 and 48 ft. semitrailers are well suited to U.S. backhauls which tend to be lighter commodities. Prior to U.S. deregulation, the company did not actively seek backhauls. However, as this is now possible, the advantages of longer equipment are becoming greater.

The interviewee made the comment that in the kind of business that Coughlan is in, the payoff from tri-axle versus tandem operations is marginal at best. He stated that based on his experience, he doubted that the extra revenue from higher payloads would be sufficient to justify the extra investment.

Most of Coughlan's gravel hauling is short haul (20-30 mile lengths of haul). Two of the dump trailers are 26 feet long and the other is 24 feet long. They are well suited to the short haul gravel operations which often involve manoeuvering in tight areas. Tri-axle dumps would have to be at least 35 feet long and would only be economical in longer haul operations. Therefore Coughlan does not expect to purchase any tri-axle dump trailers.

3.8.3 Existing VWD Regulations - Issues

The major problem for this company with respect to the VWD regulations is axle loading. As a small truckload operator, this company's units are almost always loaded by shippers. The shippers have little concern about the distribution of the load over the axles and furthermore want to maximize payload. Hence when Coughlan's drivers leave the shipper's dock they almost never know whether their load exceeds GVW or axle load limits. The potential for overloading is greater as the length of the trailer increases because of factors which can contribute to overloading such as the moisture content of lumber products and peat moss. According to the interviewee, the consequences of overloading are most severe in the U.S. because of the tough bridge laws which are in force.

This company hauls a significant amount of freight under special permit. The permits are not usually difficult to obtain, however, they are usually not available until 48 hours after the request is made. Frequently, shippers exert pressures on the carrier to transport oversize or overweight loads prior to obtaining permission. This carrier has adopted a policy of asking the shipper, where possible, to seek the special permit.

This case study illustrates many of the vagaries of competing as a small truckload operator. The company's fleet may not be optimal in relation to what is permitted under the existing regulations. However, much of the equipment was bought secondhand in order to minimize overhead.

3.9 STRESSCON

3.9.1 Background

Stresscon is a manufacturer of heavy structural members. The company ships its products throughout Atlantic Canada and the eastern United States. Concrete bridge girders and concrete wall panels are two examples of the kind of structural products it produces.

The company owns one tractor, one flatbed and six tri-axle semitrailers. A for-hire carrier, Ralph Transport Ltd., is engaged for the remainder of its transportation needs.

The company's tri-axle semitrailers have a 12 ft. overall spread with 6 feet between each pair of axles.

3.9.2 Existing VWD Regulations - Issues

Two major problems were cited with respect to the vehicle weight and dimension regulations. The first relates to the difficulty in loading semitrailers such that the axle load restrictions will not be violated. This is extremely difficult to accomplish given the kind of structural members which are being shipped. For example, a 25 foot long girder, which may weigh up to 50,000 pounds, has to be loaded towards the back of the trailer in order to satisfy the axle load regulations. However, with this loading arrangement, severe stresses are imposed on the trailer and considerable bending of the trailer results.

The second major problem posed by the regulations relates to maximum allowable heights. The 13 foot 6 inch height restriction becomes a problem when loading 8 foot wall panels on a flatbed. Considerable care has to be taken in loading to ensure that the height restriction is not violated.

This case study illustrates how the weight regulations seem to be totally focused on the interaction between the trailer and the road surface. The regulations in most provinces appear to have a regard for such factors as axle ratings, tire load ratings and the capacity of suspension systems. However, the regulations do not explicitly reflect any concern for the stresses that are imposed on the structure of the trailer itself. This is an important consideration, particularly for trucking operations which involve the haulage of very heavy freight.

3.10 SUNBURY TRANSPORT LTD.

3.10.1 Background

Sunbury Transport is a truckload operator based in Fredericton, whose primary operations are between New Brunswick/Nova Scotia and the U.S. Major commodities include forest products (newsprint, wood pulp and chips), building products, and beer. Most of Sunbury's customers are large shippers.

3.10.2 Equipment/Operations

The company relies totally on owner-operators, with a total of 170 in Canada.

Sunbury's trailer fleet consists of 25 tri-axle flatbeds, 50 tandem-axle flatbeds and 230 tandem-axle vans. The tri-axles all have 16 foot overall spreads with 10 and 6 ft. spreads between axles. Of the 280 tandem-axle semitrailers, 100 have 60 inch spreads and the remainder have 72 inch spreads. This mix is attributable to the fact that approximately 85% of their operations are to the U.S. where only a 54 inch spread is necessary in order to achieve maximum payloads on a tandem-axle semitrailer. Sunbury believes that a 60 inch spread is a good compromise between the 54 inch required in the U.S. and the 72 inch required to maximize payload on the tandem semitrailer in New Brunswick, taking into account higher operating costs resulting from greater spreads.

Approximately half of the vans are 48 feet in length with the other half being 46 feet in length. The 48 foot equipment is very useful for U.S. backhauls which, for Sunbury, often involve high cube commodities such as insulation and empty containers. The company does not have a cube problem on its head hauls.

Trailer equipment is depreciated over seven years for accounting purposes. This is very close to the actual physical life of the trailers. According to the interviewee, forest products impose considerable "wear and tear" on trucking equipment.

The company owns one set of trains which are used in short hauls to transport lumber between mills.

This company appears to have considerable interaction with trailer manufacturers prior to finalizing an equipment purchase decision. On a recent trailer order, management made three separate trips to the equipment supplier to discuss such factors as rigidity and structural soundness of the trailers as well as competitive factors in terms of commodities to be hauled and lanes of operation, in order to optimize the configuration within existing VWD regulations. Considerable emphasis is also placed on reducing the tare weight of equipment as any progress made translates directly into increased payload.

3.10.3 Existing VWD Regulations - Issues

Sunbury hauls hog fuel to various consumers of such fuel within the province using tri-axle equipment at a GVW of 110,000 pounds. The interviewee noted that in Quebec, the same fuel can be hauled on a tri-axle at a GVW of 124,000 pounds or on a four-axle semitrailer at a GVW of 147,000 pounds or a five-axle at a GVW of 154,000 pounds (under special permit). His argument was that New Brunswick consumers of hog fuel are paying a premium relative to Quebec consumers because of the different payloads that are possible in each province in the trucking of the fuel.

Regarding spring weight restrictions, the most serious impact is on tri-axle operations since their tandem-axle semitrailers are normally only loaded to the 80,000 pound GVW permitted by U.S. regulations. When payload penalties result from spring restrictions, company policy is to attempt to split the cost with the customer where competitive conditions permit. Another company policy is that the owner-operator should not absorb any portion of the cost associated with the payload penalty as this would ultimately affect safety of operations if owner-operators did not earn adequate income. The interviewee added that most customers are understanding of the need to raise trucking rates to compensate for the effects of spring weight restrictions.

Sunbury appears to have a good working relationship with its owner-operators. In addition to taking measures to ensure that they earn adequate income, Sunbury has instituted programs to increase safety of operations. For example, approximately 90% of the owner-operators now have engine brakes (JAKE brakes). The company provided financial assistance to those owner-operators who requested it.

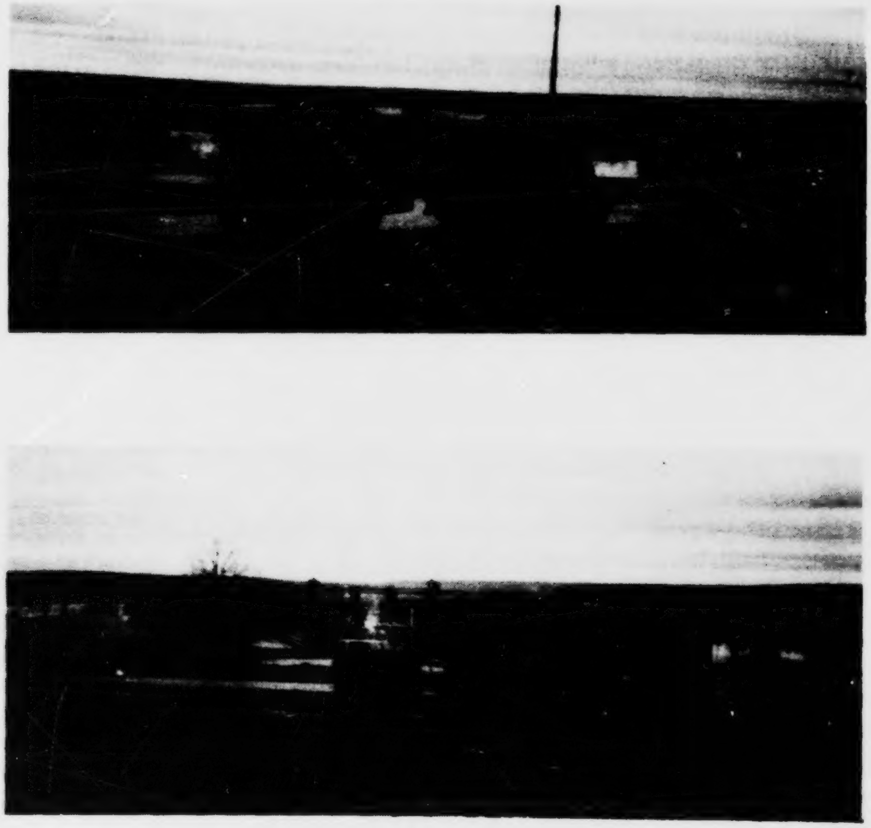

Figure 3.11.1 Atlantic Canada: 3-S3's

4. Case Studies: Quebec & Ontario

4.1 BRAMPTON BRICK

Brampton Brick operates a fleet of trucks from its main plant located on the outskirts of Brampton. It has other plants, but these were not included in the information obtained during the interview. The fleet consists of the following (rough estimates):

- Four truck-plus-trailer (4-4's) are the newest component of the fleet. The dimensions are shown in the top of Figure 4.1.1 (these are approximate), and pictures are shown in Figure 4.1.2. The dimensions in Figure 4.1.1 are on the basis of rough measurements in the shop and the tare and gross weights are partly estimated -- in particular, the weight of the extra axle on the truck (axle #2 in the configuration) is not known but is estimated at 2,000 lbs.)

- Six or seven 7-axle units (3-4's) used to be the main component of the fleet for local deliveries. Dimensions for one of the 3-4's are shown in the middle of Figure 4.1.1

- There are a few tractor-semitrailers (3-S3's and/or 3-S4's) used for long-hauls between Ontario and Quebec -- a rough sketch of the 3-S4 used is shown in the bottom of Figure 4.1.1.

- There is a variety of other equipment around the yard (eg, smaller, older straight trucks used for small orders, etc.)

As there were some 3-axle trailers in the yard, some of the straight trucks (either the four 4-4's or the six to seven 3-4's) are sometimes used with one less axle than the configurations listed here -- ie, as 4-3's or 3-3's. Although it is not a Brampton Brick vehicle, a 4-3 hauling bricks is shown in Figure 4.1.3.

Points to note about the 4-4 and 3-4 configurations are:

i. Axle #2 on the 4-4 (a *pusher*) is lifted when not carrying a load. It is placed 100 inches (2.54 m) in front of the first drive axle to avoid a 3-axle group load (ie, as axles #2, #3, and #4 fall outside the definition of a 3-axle group, axle #2 is allowed its full load of 10,000 kg).

ii. It can be shown on paper that an eighth axle is redundant in the sense that the additional tare weight reduces the potential payload. Seven-axles, properly configured, can be registered at 63,300 kg; the addition of an eighth axle -- which weighs more than 200 kg (the increase from 63,300 to 63,500 kg) -- reduces the payload. However, in the particular case of Brampton Brick, the 4-4's do have larger payloads than the 7-axle units -- roughly 1,000 kg.

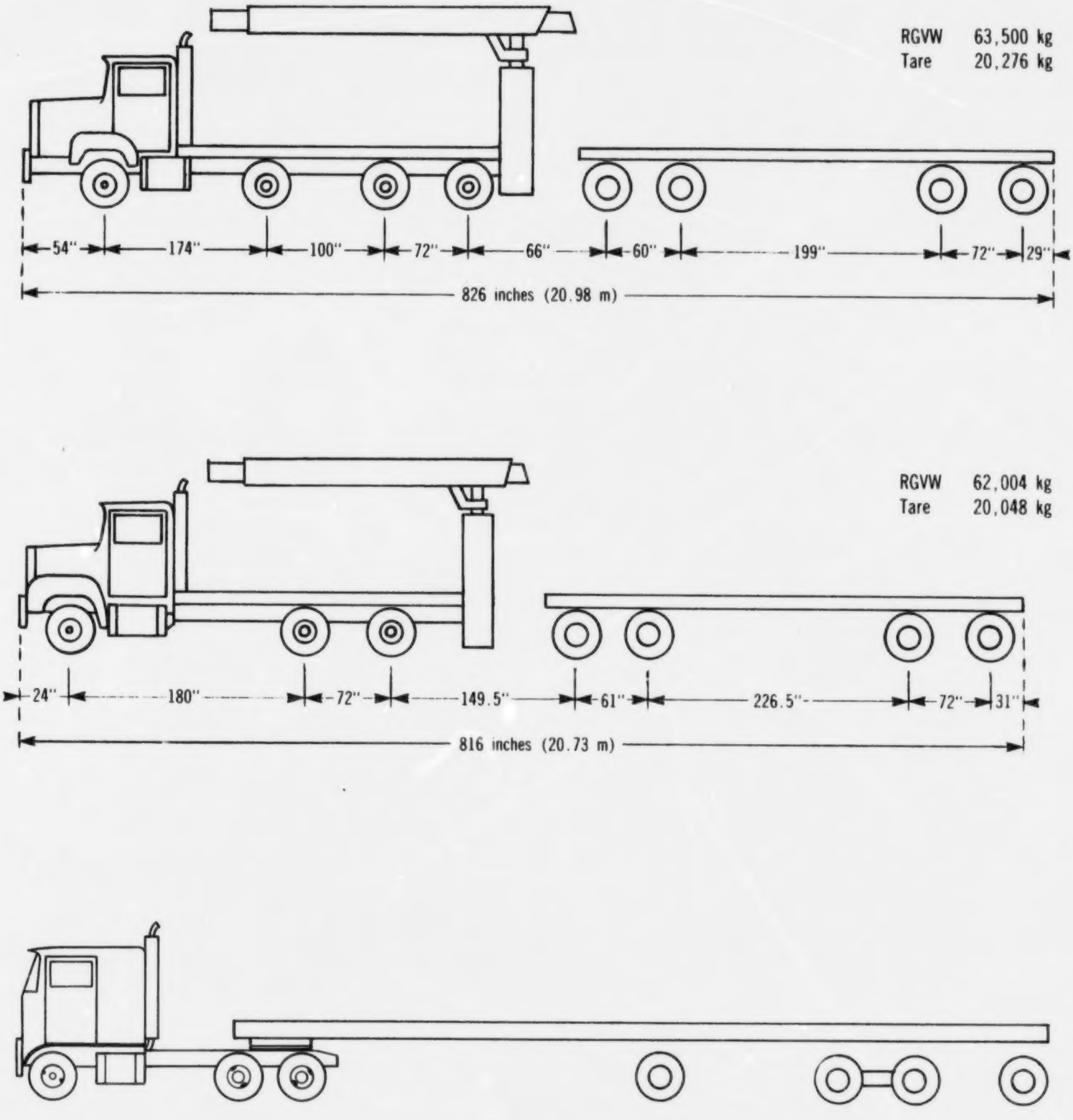
RGVW 63,500 kg
Tare 20,276 kg
54"
174"
100"
72"
66"
60"
199"
72"
29"
826 inches (20.98 m)
RGVW 62,004 kg
Tare 20,048 kg
24"
180"
72"
149.5"
61"
226.5"
72"
31"
816 inches (20.73 m)

Figure 4.1.1 Brampton Brick: Configurations

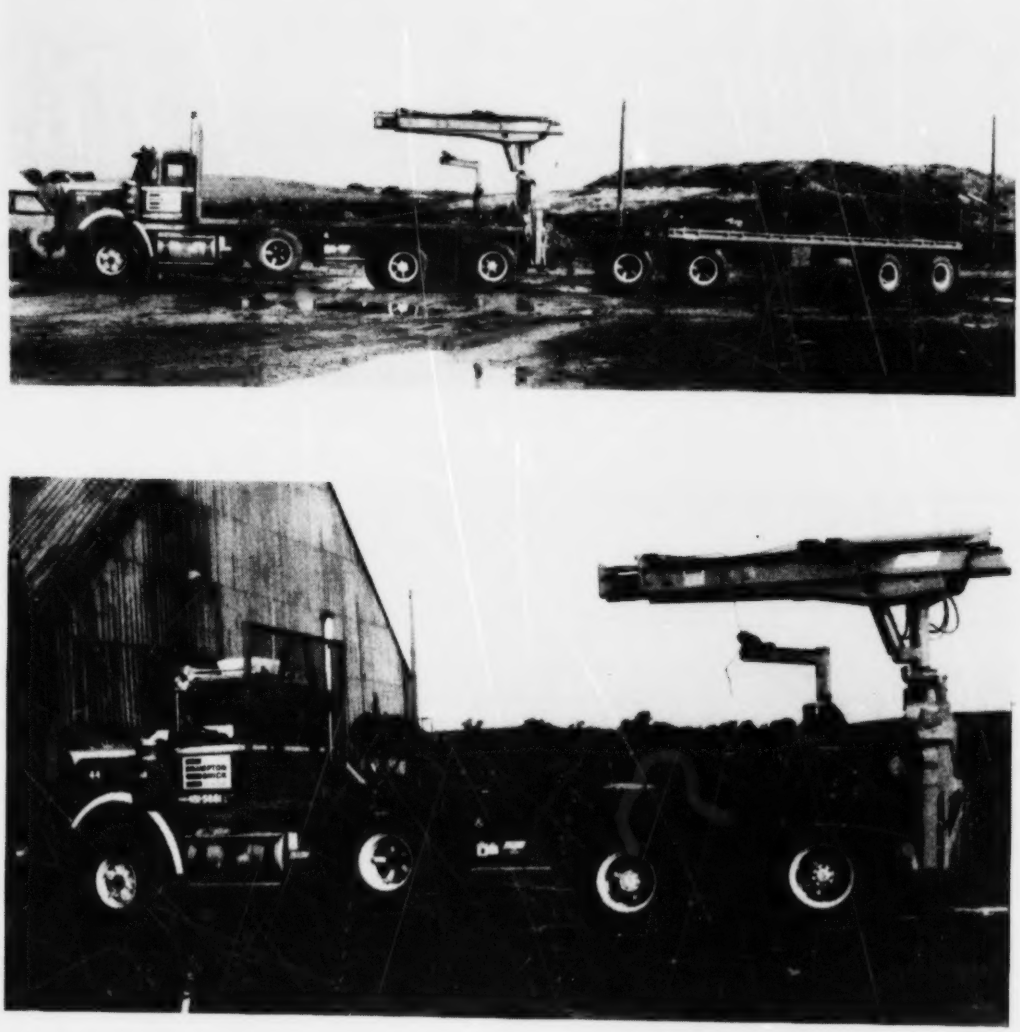
BRAMPTON BRICK

Figure 4.1.2 Brampton Brick: 4-4

iii. The main reason given for the use of 4-4's instead of 4-3's or 3-4's is the increased safety (more braking power) and ease of handling (the 4-axle trailer is easier to back up than a 3-axle, and does not sway as much when running).

iv. Front tires are 18 inch (18 x 22.5), in order to load the full 9,000 kg on the front axle. On the 4-axle trucks, as the vehicle is being loaded, axle #2 is in the raised position and the front axle load goes up to about 13,500 kg -- until the "pusher" is lowered.

v. During the interview, the extra payload of the 4-4's over the 7-axle units did not seem to be a major point. Both units can load to about 90,000-95,000 lbs. In this type of operation, the payload is "lumpy"; that is, each additional pallet of bricks weighs something like 2,500 lbs. The 7-axle units carry 37 such pallets, and the 4-4 can handle up to 38.

vi. In terms of operational considerations, the use of the truck-plus-trailer is the only way to perform the local deliveries, given the maneuverability required at construction sites. The 3-4 shown in Figure 4.1.1 has a turning circle of 36 ft. In tight spots the truck drops the trailer, goes in to the delivery site to unload bricks, comes back out, transfers the trailer load to the truck, and goes back in to unload again. With this configuration, the trucks can easily be used by themselves for smaller orders.

vii. The two trailers shown (a 30' with the 4-4, and a 33' with the 3-4) are just two of several sizes of trailers the company operates (they were all in the 30 33' range). The "H.D Turntable" on the trailer consists of an "A" shaped draw bar, a pintle hook on the truck, and two turning tables (roughly 3' or so in diameter) on the trailer.

The company has no complaints about existing Ontario regulations, although the fact that Ontario and Quebec have different regulations was mentioned. It is not clear how the different regulations affect this operation; the company is currently running one 3-S3 and possibly one 3-S4 on this route. Other than Quebec's lower allowed GVW (57,500 versus 63,500 kg) there were no major frictions between the two sets of regulations.

There have been no changes to the fleet as a result of recent regulatory changes (*the 23 m change in Ontario did not mean anything to this operation*).

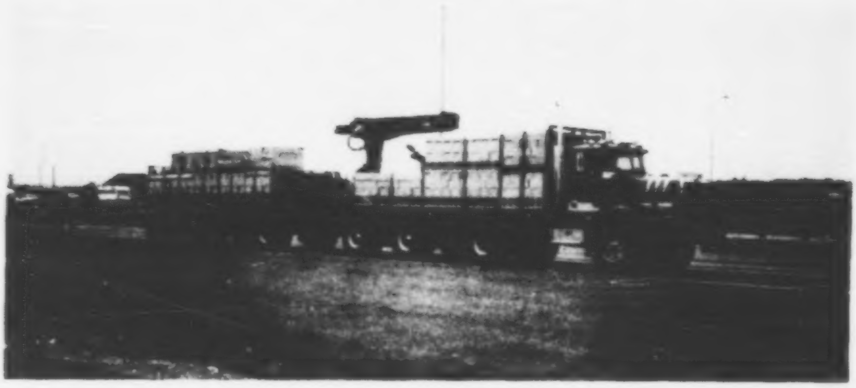

Figure 4.1.3 Ontario Brick Hauler: 4-3

4.2 CP TRUCKS

The interest with CP Trucks' fleet is its operation of double 28 foot pups across Canada -- the interest being that with the U.S. regulations, it is assumed that 28 foot pups will be a major factor in North American trucking in future years. CP Trucks also operates triples, Rocky Mountain doubles, and turnpike doubles; however, these are all under special permit.

The dimensions of the double 28's are shown in Figure 4.2.1 and pictures are contained in Figure 4.2.2; points to note are as follows:

i. This particular pup design was developed prior to the regulatory change (in Eastern Canada) allowing 23 m in over-all length. While the dimensions of the tractor used during the interview are not shown in the Figure, any COE tractor with a wheelbase of about 150 inches or less would result in an over-all combination length of 21 m.

ii. The pup has been designed to be compatible with the entire CP Trucks' system: the lead and second pups are identical; the pups can be used in triple operations; and the pups can be combined with 45' or 48' semitrailers in Rocky Mountain double configurations. Presumably, another point about compatibility is that these pups and this configuration are compatible with optimal configurations in the U.S.

iii. One of the major reasons for adopting this type of configuration is that CP Trucks runs a national hub-to-hub LTL freight service: at the terminals these pups can be split and taken into the urban areas for P&D operations, or, individual pups can be dropped along the route to be re-combined with other equipment heading for different terminals.

iv. The kingpin-to-rear distance is 658 inches (16.71 m), thereby allowing the use of this configuration in all provinces from Quebec to B.C. Note that (a) they may also operate into Atlantic Canada under special permit (this is speculation); (b) there would be no problem operating this configuration in Quebec and Ontario if the 16.75 m limit were exceeded, as long as the back-of-cab-to-rear-of-combination did not exceed 19 m*; and (c) the method used to achieve this kingpin-to-rear length is the kingpin setback of 48 inches (it is understood that at 48" -- or anything over 48", there is a problem in placing the landing gear on these pups in a manner that will not result in a nose-heavy situation).

v. The pups are not true 28' semitrailers, as the narrow nose and the bulkhead (20" from the front) reduce the useable space to about what is available in a 27' pup (ie, 26'10"). In fact, it is not clear what advantages these 28' pups have over the more conventional double 27' pups used by many Canadian LTL carriers (see Figure 5.9.4).

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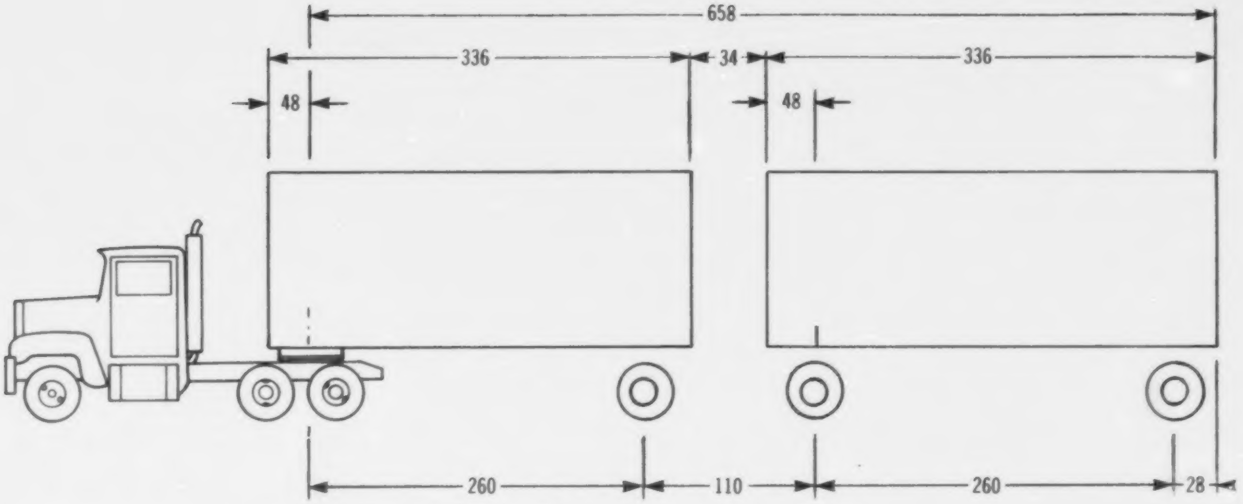
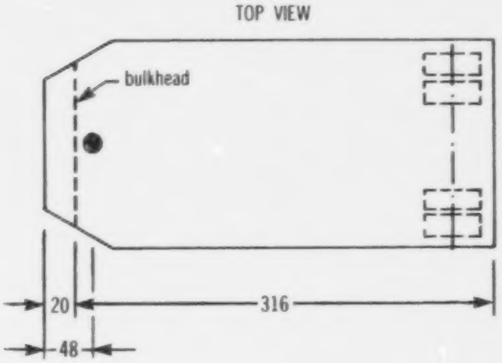
* *Saskatchewan advises that they are no longer enforcing the 16.75 m kingpin-to-rear limit.*


658
336
34
336
48
48
260
110
260
28


TOP VIEW
bulkhead
20
316
48

NOTES

i. All measurements in inches.
ii. Effective trailer length is 26'10"
iii. Kingpin-to-rear is 658" (16.71 m)

Figure 4.2.1 CP Trucks: Double 28 Foot Combination

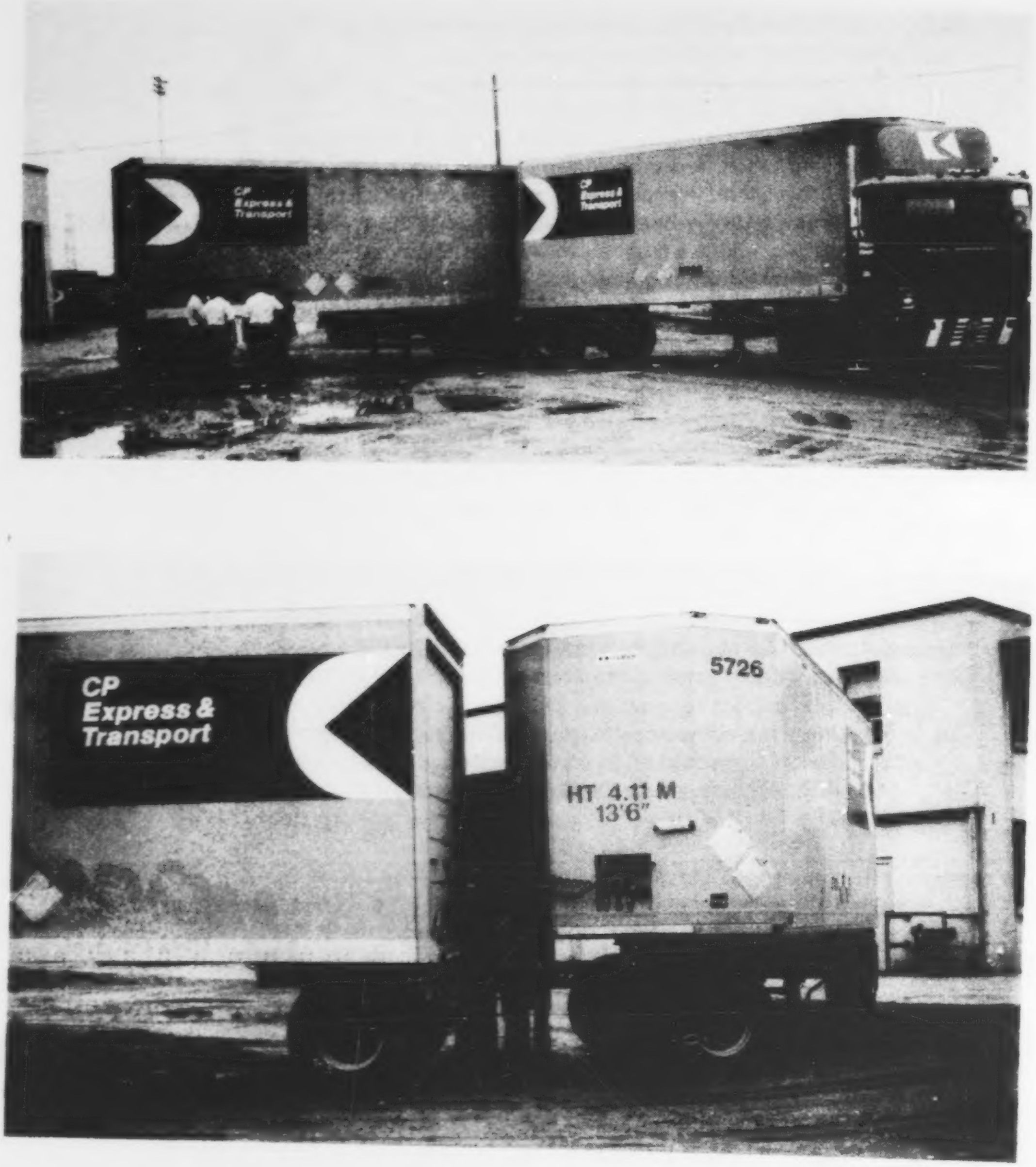

CP
Express &
Transport
CP
Express &
Transport
CP
Express &
Transport
5726
HT 4.11 M
13'6"

Figure 4.2.2 CP Trucks: 3-S1-2

vi. The front of these pups have been designed to allow adequate swing clearance on corners. (It is understood that at least 36" between trailers is required for "flat" or square-nosed pups at 102" widths. The actual distance between CP Trucks' pups is about 29"-34" -- it was measured at 29", however, to make the other dimensions "add up" when Figure 4.2.1 was prepared, it seems that there had to have been at least 34".)

The following table shows the allowable axle loads, maximum GVW, and the effective maximum payload in provinces from Quebec to B.C. It has been assumed that the power unit is a 190" wheelbase tractor with 72" tandems and a tare weight of 18,000 lbs. Further, 5,500 kg front axles are assumed throughout. Note that: (a) it is unlikely for this combination to weigh-out hauling LTL freight so that maximum GVW is not a major issue; (b) the sum of the allowed axle loads do not generally equal the maximum GVW (see the notes); and (c) the tare weight of the pups is 9,162 lbs., so that the over-all assumed tare weight is 36,324 lbs.

Notes on the calculations in Table 4.2.1 are as follows:

i. In Quebec, the critical distance in terms of total GVW is between axles #2-#6. In the configuration shown in Figure 4.2.1, this distance is 16.91 m (666"), well above the 14 m limit (ie, for spacings less than 14 m, a GVW load-reduction penalty applies).

ii. The major reason for the low GVW in Ontario is the inter-vehicle-unit-distance of 2.8 m (110" between axles #4-#5). If it were not for this, the allowed GVW in Ontario would be similar to that in Quebec.

iii. The sum of the allowed axles loads in Manitoba is 48,800 kg. However, as the distance from axle #4 to #5 (a single-to-single) is only 2.8 m, this total of 48,800 has to be reduced by 2,310 kg (7 X 330) for an allowed GVW of 46,490 kg.

	maximum axle loads					Maximum	Effective
	front	tandem	single	single	single	GVW	Payload
Que.	5,500	19,000	10,000	10,000	10,000	54,500	38,024
Ont.	5,500	19,100	10,000	10,000	10,000	51,800	35,324
Man.	5,500	16,000	9,100	9,100	9,100	46,490	30,014
Sask.	5,500	16,000	9,100	9,100	9,100	44,600	28,124
Alta.	5,500	16,400	9,100	9,100	9,100	45,000	28,524
B.C.	5,500	17,000	9,100	9,100	9,100	49,800	33,324

Table 4.2.1 CP Trucks: Double 28's -- Que. to B.C.

iv. Allowed GVW in Saskatchewan is similar to that in Manitoba except that in this case the "single-to-single spacing" penalty is 4,200 kg (3 X 1,400). (In fact, this is so close that Saskatchewan may only reduce the GVW by 2 X 1,400 kg.)

v. The allowed GVW in Alberta is the sum of the axles loads (49,200) less 4,200 kg for the "single-to-single" distance of 2.8 m between axles #4-#5. (As with Saskatchewan, this spacing is so close that it may be interpreted as 2 X 1,400 kg.)

vi. The allowed GVW in B.C. is the sum of the allowed axle loads (no spacing penalties come into effect in this case).

4.3 GRAVEL HAULERS

Many types of configurations are used to haul gravel (aggregates) in Ontario. Some of these are shown in Figure 4.3.1 -- all dimensions and loads are in metric units. The following notes provide detail as to the choices between the different configurations, even though not all of the advantages or disadvantages are known.

i. All configurations shown on Figure 4.3.1 have been given 72" (1.8 m) tandem spreads in order to have the highest tandem-axle loadings (19,100 kg). In practice, many of the configurations on the road may have 60" (or even 48") drive tandems as the GVW's are not generally constrained by the "sum of allowed axle loads" (most GVW's are constrained by Ontario's tables -- the Bridge Formula).

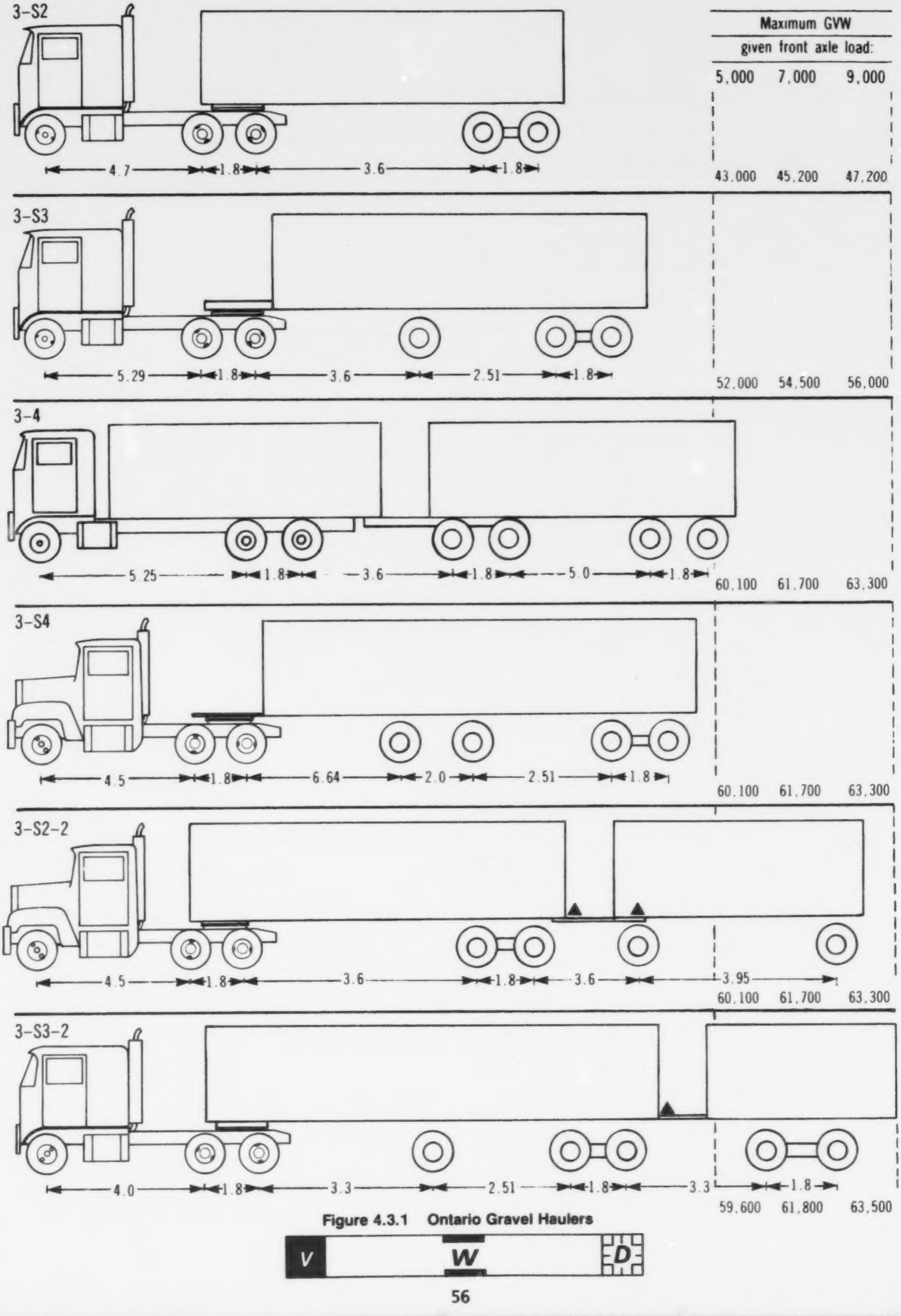
ii. The two methods used to unload gravel (dump versus hopper bottoms) are not shown in Figure 4.3.1 as not enough details are known. For some configurations it is difficult to place the hopper mechanisms in among the running gear. In terms of where the two types of mechanism are used, hopper bottoms are used on highway projects and other destinations capable of handling hoppers (with conveyer belts and pits suitable for this type of unloading). Most other destinations require end-dump equipment.

iii. Gravel haulers in Ontario do not appear to have problems with the total load on the vehicle (of the hundreds seen, none were overloaded on GVW), but they do have problems with overloaded axles. In making this observation, however, it must also be noted that some vehicles were known to be by-passing the scales (presumably some of these might have been avoiding the scale because they were overloaded on GVW).

In terms of each of the configuration types shown in Figure 4.3.1, the following notes provide what information was picked up during an interview with one large operator (Muscillo Transport -- which has a 100 or so owner-operators working for it) and during discussion with Ministry officials at a weigh scale (where most of the traffic moving over the scales was gravel equipment).

4.3.1 The 3-S2

3-S2's are only used on minor gravel hauls. The configuration shown in Figure 4.3.1 has been drawn such that it is at the maximum GVW possible for this type of equipment (there is a minor exception to this where the semitrailer axles are both independent single axles, in which case a few more kilograms could be loaded). To


3-S2
4.7
1.8
3.6
1.8
3-S3
5.29
1.8
3.6
2.51
1.8
3-4
5.25
1.8
3.6
1.8
5.0
1.8
3-S4
4.5
1.8
6.64
2.0
2.51
1.8
3-S2-2
4.5
1.8
3.6
1.8
3.6
3.95
3-S3-2
4.0
1.8
3.3
2.51
1.8
3.3
1.8

Maximum GVW given front axle load:		
5,000	7,000	9,000
43,000	45,200	47,200
52,000	54,500	56,000
60,100	61,700	63,300
60,100	61,700	63,300
60,100	61,700	63,300
59,600	61,800	63,500

Figure 4.3.1 Ontario Gravel Haulers

achieve this maximum GVW, the configuration requires a minimum base length (first-to-last-axle) of 11.75 m and a minimum inter-vehicle-unit-distance of 3.6 m. In Figure 4.3.1, this has been achieved by giving the configuration an inter-vehicle-unit-distance of precisely 3.6 and adding the additional required length to the wheelbase of the tractor (ie, 220" wheelbase). There are other options that would achieve the GVW shown.

4.3.2 The 3-S3

The 3-S3 is a common type of gravel truck on the major hauls. There are many varieties of this configuration -- the one shown in Figure 4.3.1 is a "goose neck" in that the trailer has an extended front end to contain the kingpin. The goose neck is used to stretch the configuration out such that it has a base length of 15.0 m. Whether or not the many goose necks on the road actually have base lengths quite this long is not known. Without having any figures, it seems that there is a trade-off to be made with this type of configuration: extending the length with the goose neck in order to get a longer base length and a higher GVW, versus the lighter front axle load (which lowers GVW) that occurs as the semitrailer is extended further and further back.

The available alternatives for extending lengths seem to be: (a) goose necks (ie, extending the front of the semitrailer), (b) long wheel-base tractors, (c) positive fifth wheel offsets (back of the tandems) and/or very short kingpin settings, and (d) extended axles at the back of the combination. This last possibility (a tandem axle set out behind the box) is shown in the bottom of Figure 4.3.5. All of these alternatives appear to suffer from the same trade-off just discussed (ie, while they increase base lengths, they reduce front-axle load).

Other 3-S3's seen included an arrangement where the third axle on the semitrailer sat behind the tandems.

4.3.3 The 3-4

There are many truck-plus-trailer configurations on the road. Two are shown in Figure 4.3.2 -- note that the one at the top uses a dump trailer while the one at the bottom uses a hopper-bottom trailer. The advantages of this configuration are not fully known, but it is speculated that this is used where the operator wants the flexibility of having a 3-axle dump truck to use when business does not require the full configuration. The one shown in Figure 4.3.1 has been drawn with a base length of 19.25 m and an inter-vehicle-unit-distance of 3.6 m. From visual observations it appears that most of these configuration on the road have much longer drawbars than that shown in Figure 4.3.1 -- the total box length is not very great (given the density of the commodity) and to achieve a base length of 19.25 m, most of these configurations have to stretch the distance between the truck and the trailer.

4.3.4 The 3-S4

Although the 3-S4 (Figure 4.3.6) is not seen in great numbers, some believe this configuration is relatively efficient -- notice (in Figure 3.4.1) that in comparison to

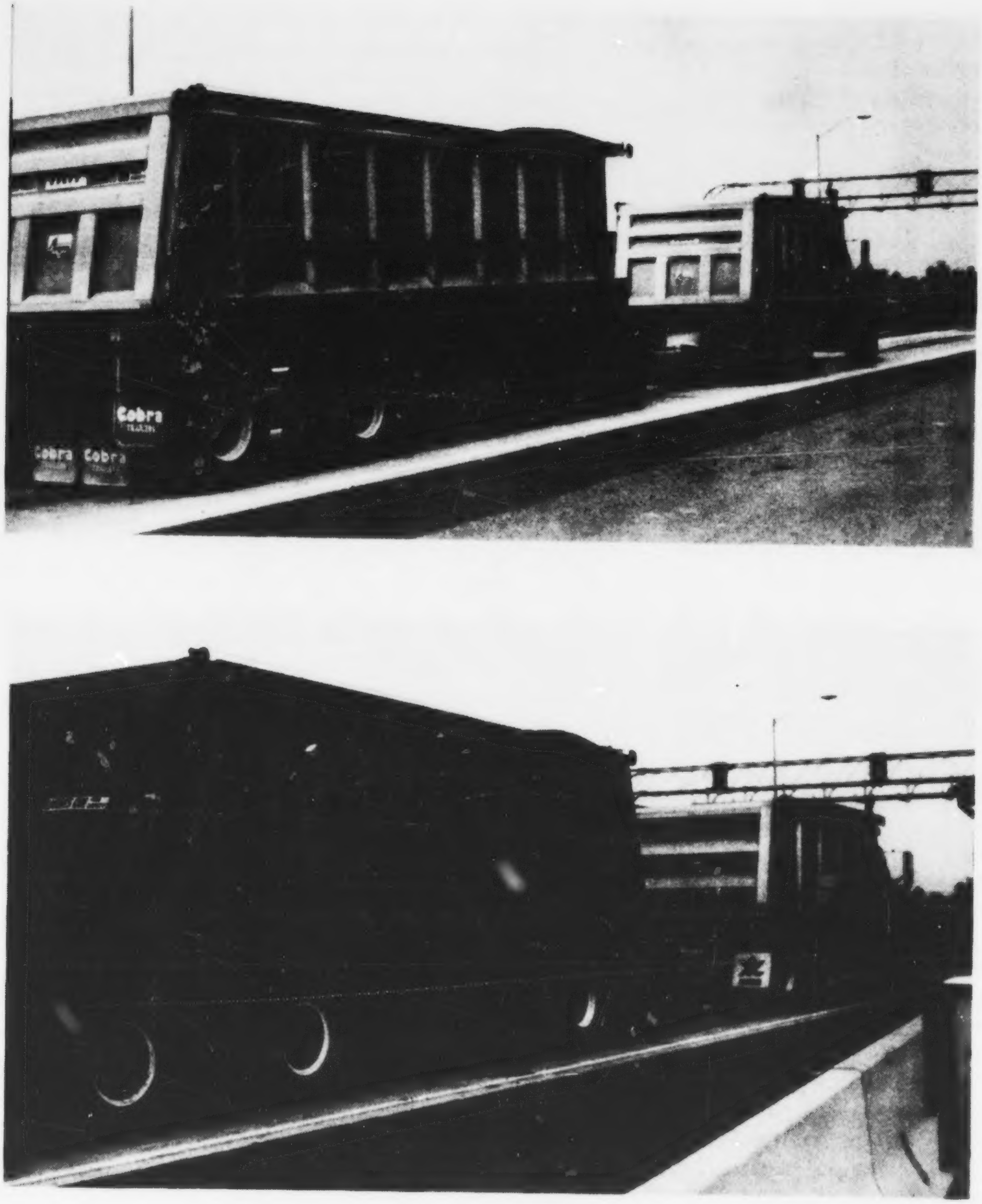

Cobra
Cobra
Cobra

Figure 4.3.2 Ontario Gravel Haulers: Truck-Plus-Trailer

the 3-S3 there is an additional payload capacity of roughly 6,000 kg (an increase of about 7,000-8,000 kg in GVW less about 1,000 kg for the extra axle). The counter arguments are that the tire wear on these configurations is so great that some of the efficiency gains are lost.

The particular 3-S4 shown has been given a base length of 19.25 m, an inter-vehicle-unit-distance of well over the required 3.6 m (ie, 6.64 m), a spacing of 2.51 m between the semitrailer tandems and the first air-lift axle (so that the three axles so not constitute a "three axle group") and a spacing a 2.0 m between the two air-lift axles (so that the two axles do not constitute a "two axle group").

4.3.5 The 3-S2-2

The 3-S2-2 is relatively common -- particularly with hopper-bottom equipment. On the configuration shown in Figure 4.3.1, the base length is 19.25 m, and both inter-vehicle-unit-distances are 3.6 m. Compared to the 3-S4, this configuration is apparently easier on tires, but somewhat more difficult to manoeuver (it can't back up). The ones actually seen had tare weights in the range of 41,000-42,500 lbs. giving these units a payload potential of about 90,000-95,000 lbs. (depending on front-axle load). The one shown in Figure 4.3.1 with a 9,000 kg front axle has a theoretical payload potential of about 44,700 kg (98,570 lbs.) A point to note about this configuration is that Ontario's highest GVW of 63,500 kg is almost achievable on 7-axles.

Two pictures of 3-S2-2's are shown in Figure 4.3.7 -- note the different axle spacings on the pup and the related difference in heights (ie, the one shown at the top of Figure 4.3.7 has a short spacing and load-extenders at the top of the box).

4.3.6 The 3-S3-2

Several varieties of 3-S3-2's were seen -- the one shown in Figure 4.3.1 has a "pony" trailer, and two pictures of these configurations are shown in Figure 4.3.3. The use of this pony trailer reduces the number of articulation points to two from the three that would be found in the equivalent A-train. The advantages of this configuration are hard to see in that the extra GVW available is almost certainly accounted for by the additional tare weight. However, there are three points to consider: (a) all configurations shown in Figure 4.3.1 have been drawn to provide the maximum GVW -- in practice, many of the configurations might be less than this, so that it is not clear that the 7-axle units will actually have almost the same GVW as the 8-axle; (b) given the loading characteristics of aggregates, it may not be possible to load 7-axle configurations as precisely as required (in other words, the extra eighth axle may be needed so that over/under weights on particular axles are not so critical); and (c) one of the advantages of the 3-S3-2 not apparent from the information shown in Figure 4.3.1 is that if business is slow, the pup can be dropped and the remaining 3-S3 unit is a relatively efficient hauler on its own (more so than the alternative 3-S2).

In terms of the dimensions shown for the 3-S3-2, there are several points that distinguish it from the 7-axle alternatives. First, a base length of 19.25 m is not as critical (the one shown has a base length of only 18.5 m); second, the inter-vehicle-

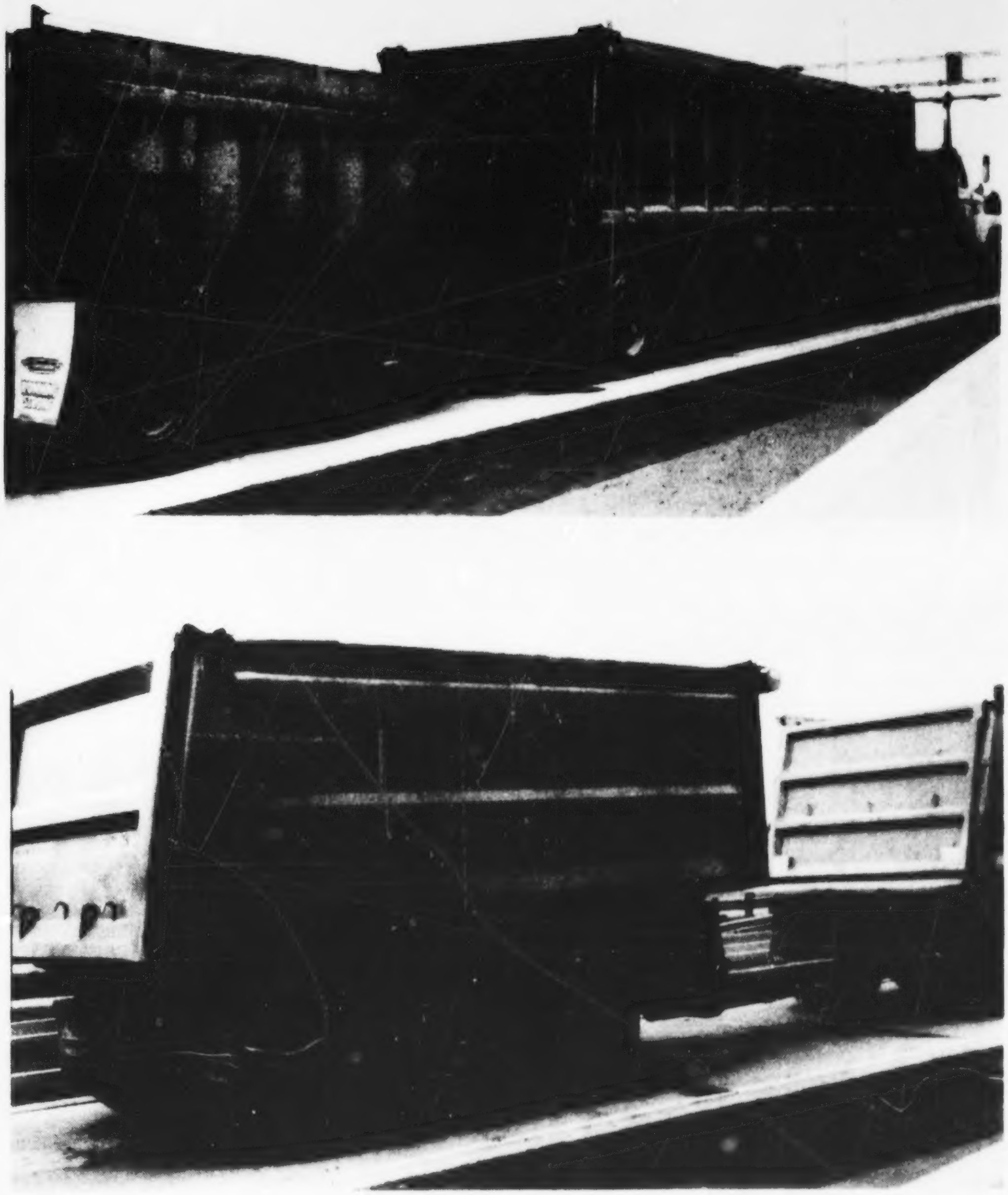


Figure 4.3.3 Ontario Gravel Haulers: 3-S3-2 (Pony)

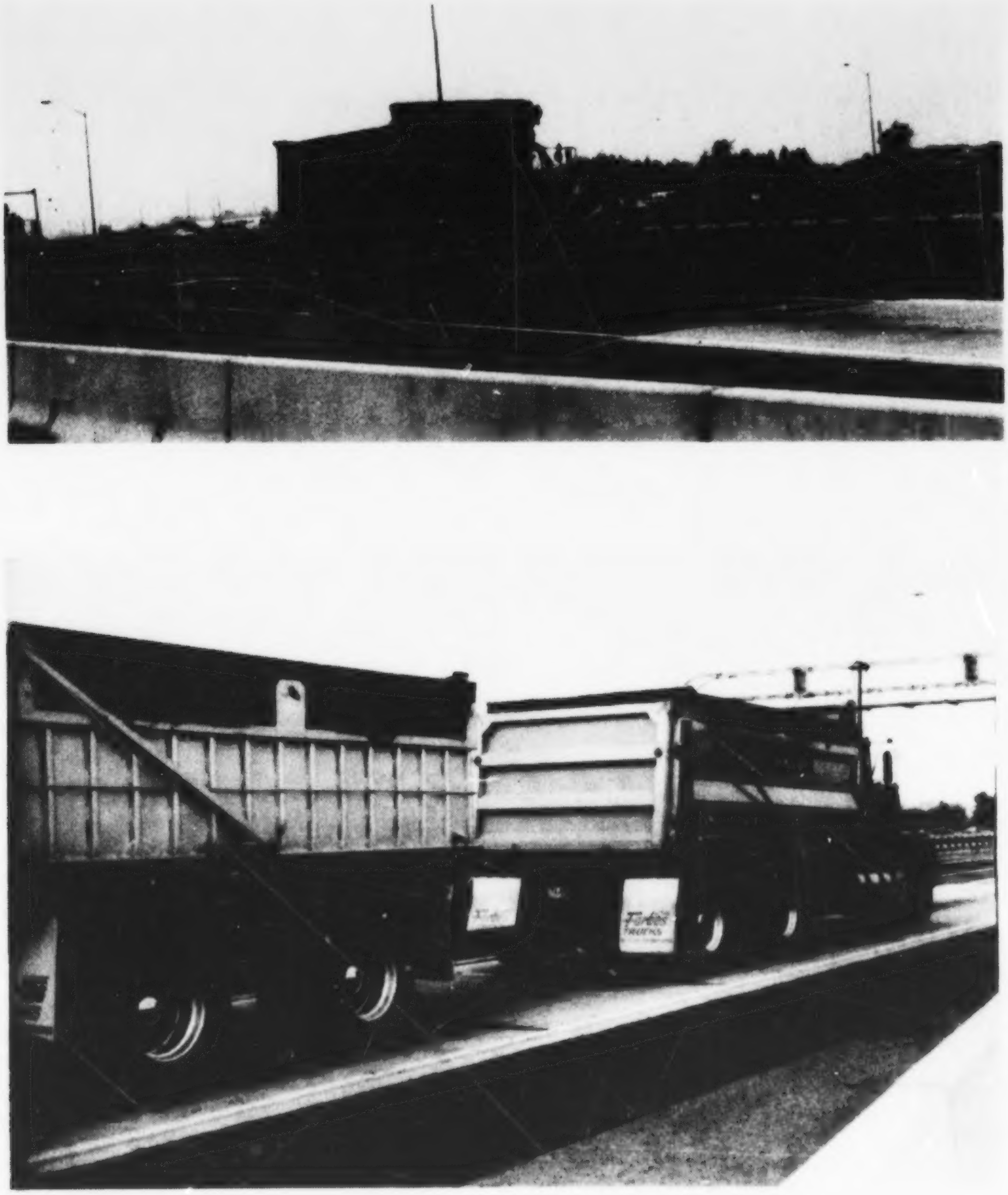


Figure 4.3.4 Ontario Gravel Haulers: 4-Axle Truck & 3-2

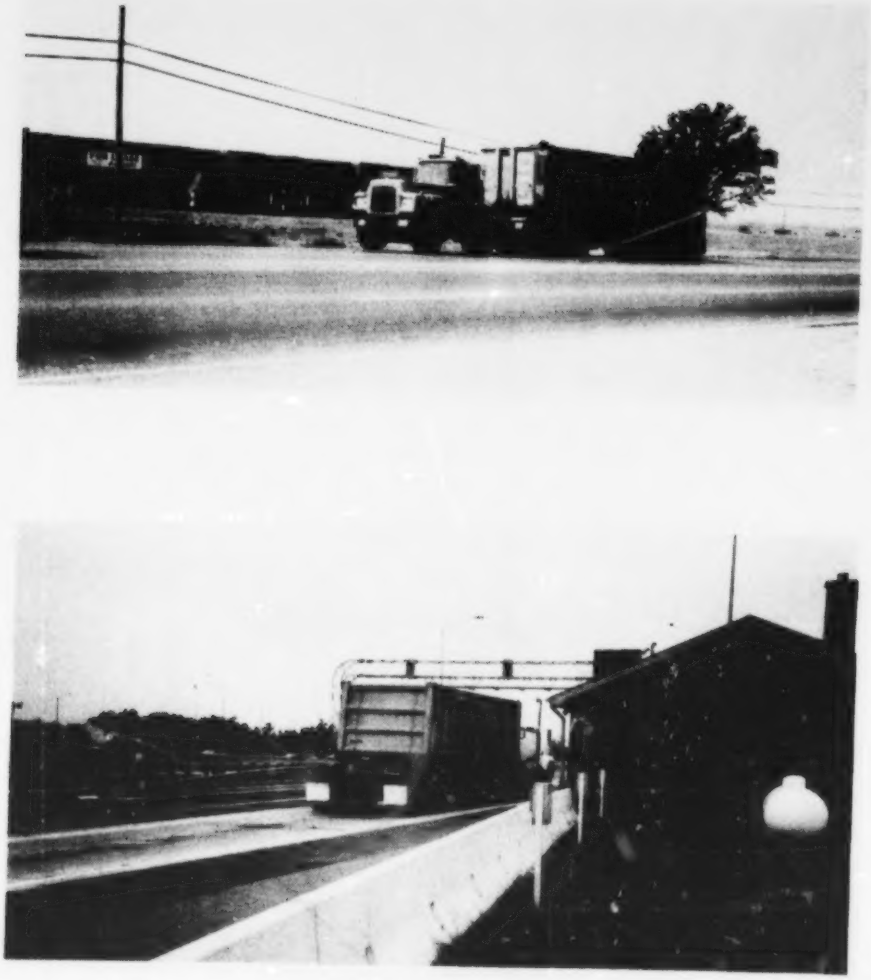


Figure 4.3.5 Ontario Gravel Haulers: 3-S3's

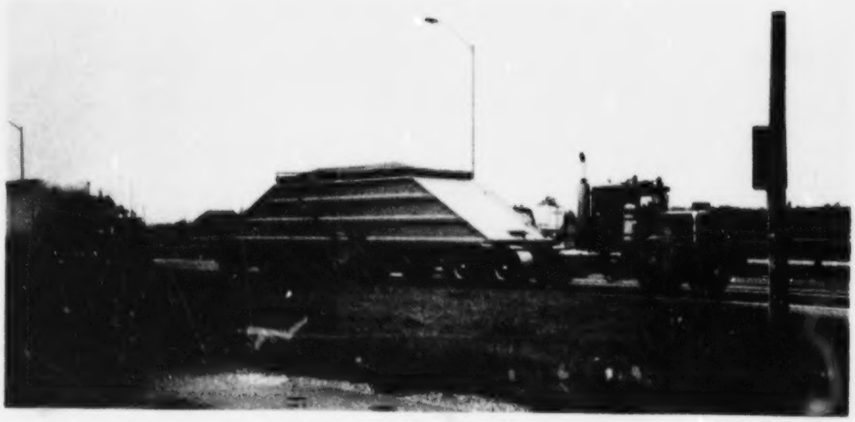


Figure 4.3.6 Ontario Gravel Haulers: 3-S4

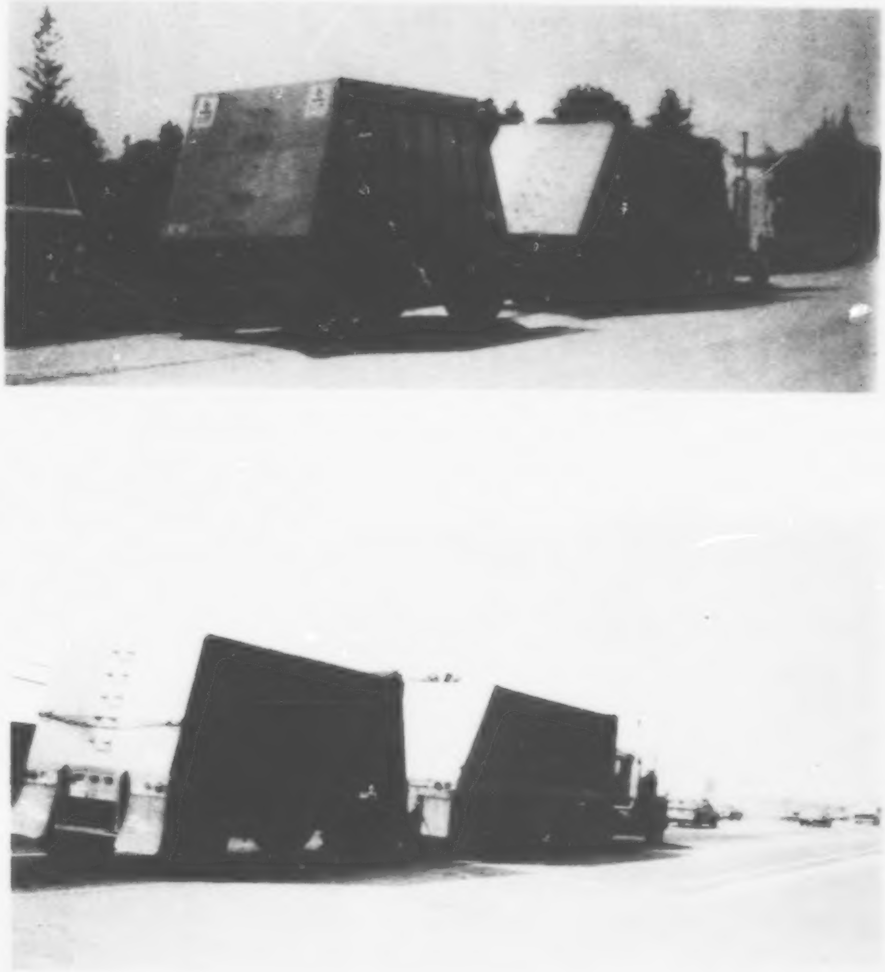


Figure 4.3.7 Ontario Gravel Haulers: 3-S2-2's

unit-distance is also not as critical (the inter-vehicle-unit-distance shown is only 3.3 m). In both cases, the addition of an extra axle means that the axle spacings become less critical to the determination of GVW.

4.3.7 The 3-S2-S2 and 3-S3-S2

Few B-trains were seen hauling gravel. The reasons for the low use of B-trains are not know, but the following speculations may be relevant: (a) the B-train has a higher tare weight than an A-train; (b) B-trains probably can be used only where hopper-bottom equipment can operate (ie, they could only be used on highway projects and/or some of the major end-point facilities); and (c) there is a loss of flexibility in comparison to the A-train (a B-train operating with only its lead semitrailer is a high-tare-weight alternative, and the second semitrailer by itself -- that is, hooked up to another tractor -- is too small to be economical).

4.3.8 Other Configurations

In addition to the configurations shown in Figure 4.3.1, there are various other types used in gravel hauling in Ontario. Two of these, a 4-axle truck and a 3-2, are shown in Figure 4.3.4.

4.4 HUTCHINSON INDUSTRIES

Hutchinson Industries in North York manufacturers aluminum and stainless steel tanks, primarily for the petroleum industry (or for-hire carriers hauling petroleum products). The company was instrumental in the development of the 8-axle B-train. Attention here is focused on three configurations:

- the 8-axle B-train (3-S3-S2), with a capacity of between 58,000-59,000 (plus) litres of petroleum products (42,340 kg to 43,590 kg). Details on several of these have been used to draw Figures 4.4.1 (Imperial Oil) and 4.4.2 (Shell).

- the 7-axle B-train (3-S2-S2), with a capacity of 55,000 + litres. While drawings for such a configuration were not obtained, a hypothetical 7-axle B-train with a capacity of 58,693 litres (43,140 kg) is shown in Figure 4.4.3.

- the 7-axle tractor-semitrailer (3-S4), with a 48' semitrailer. This configuration has a capacity of 58,000 litres and is shown in Figure 4.4.4 -- the sketch is hypothetical in the sense that no actual drawings were used for the dimensions and loads shown, but it is based roughly on tanks being built by Hutchinson Industries for Tudhope Cartage Ltd.

4.4.1 The 8-axle B-train Tanker

The 8-axle B-trains are used by Imperial Oil, Shell Canada, and others to deliver petroleum products (gasoline, diesel) to their network of retail dealers. In terms of the development of this unit, Hutchinson Industries built the first train set for Imperial Oil in 1976. The oil companies had been using 8-axle A-trains prior to this but, owing to a concern about stability, the oil industry in cooperation with the trailer manufacturing industry decided to switch to the more stable B-train. At the time these units were developed, the 45 ft. length limit on a semitrailer in Ontario meant that trains were the only option available to obtain the extra ten feet of trailer space required with this type of product. The original 8-axle B-trains had a payload capacity of 12,200 gallons (55,461 L) compared to the current 58,000-59,000 L.

These trains sets (aluminum tanks) currently cost in the range of $100,000 to $140,000 (depending on many factors -- in particular such things as the number of compartments, valves, and such things as the walkways on top of the tanks).

In terms of the Imperial Oil B-train shown in Figure 4.4.1:

i. The drawing in Figure 4.4.1 is not to scale and some details have been omitted (in particular, the rear semitrailer is shown at 307 inches in length which includes the rear bumpers etc. -- the actual tank is only 292 inches in length).

ii. The semitrailer heights, which are not shown, are 78" for the tank on the lead semitrailer with an over-all estimated height of 145", and 72" for the tank on the rear with an estimated over-all height of 139".

iii. The kingpin-to-rear of the combination is 16.97 m (668"). As a result, the combination is required to keep the back-of-cab-to-rear distance to 19.0 m or less (in fact it is shown in the drawings to be 18.9992 m).

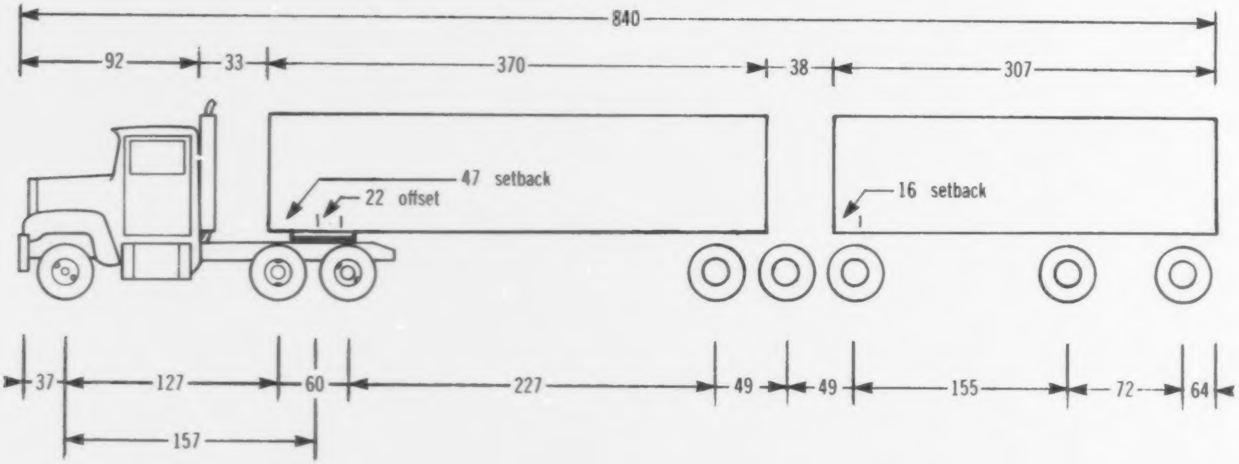
iv. To understand how and why this combination differs from the Shell B-train, it should be pointed out that Imperial Oil has opted for a vehicle that can deliver variable shipment lots to its retail dealers. That is, this unit has a number of different-sized compartments within the trailers and relies on meter read-outs when making deliveries. (It is believed that this option contributes to the higher tare weight of this combination.)

In terms of the Shell 8-axle B-train:

i. Again, the drawing in Figure 4.4.2 is not to scale and some details have been omitted (the rear tank is only 320" in length -- the dimensions shown in Figure 4.4.2 are to the extreme rear end of the combination).

ii. In comparison to the Imperial Oil combination, this unit has a lower tare weight and a higher payload. It is understood that this is (in whole or in part) related to the method Shell uses to make its retail deliveries. All but one of the compartments in this unit are 5,000 L (or multiples) in size; dealers take their shipments by the tank full (rather than variable shipments that require meters for measuring).

iii. In this case, the 16.75 m kingpin-to-rear limit has been observed (thereby releasing the 19.0 m limit). To accomplish this, the Shell tanker has 62" kingpin setback (versus 47" for the one shown in Figure 4.4.1).


840
92
33
370
38
307
47 setback
22 offset
16 setback
37
127
60
227
49
49
155
72
64
157

Tare	5,720	5,290	5,675	4,140
Payload	1,970	12,100	15,565	12,705
	7,690	17,390	21,240	16,845

NOTES

i. Dimensions shown in inches, axle loads in kilograms.

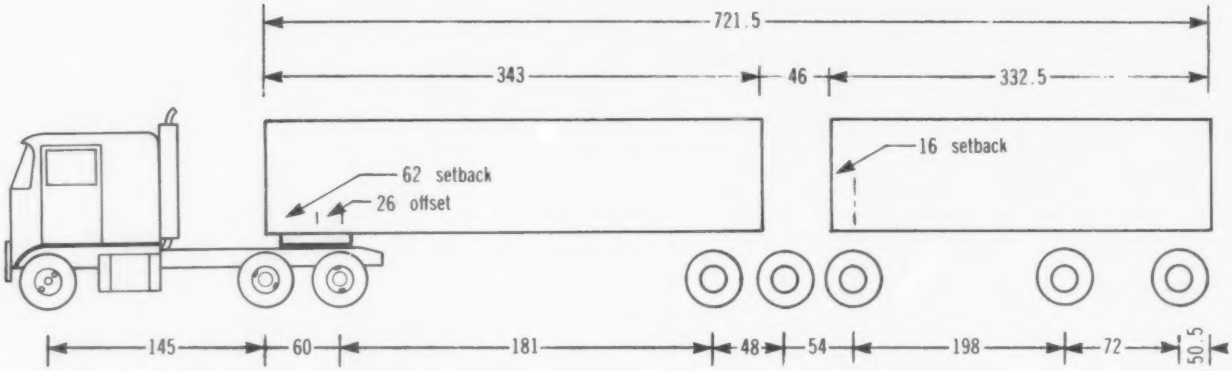
ii. Tare Weight – tractor – 9,075 kg
– lead semitrailer – 6,810
– rear semitrailer – 4,940
20,825 kg

iii. Capacity – lead semitrailer – 34,000 L
– rear semitrailer – 24,000
58,000 L

iv. Payload – 42,340 kg

v. GVW – 63,165 kg

Figure 4.4.1 Hutchinson Industries: 3-S3-S2 Tank


721.5
343
46
332.5
62 setback
26 offset
16 setback
145
60
181
48
54
198
72
50.5

Tare:	4,935	5,745	5,300	3,930
Payload:	2,070	11,310	15,560	14,650
	7,005	17,055	20,860	18,580

NOTES

i. Dimensions shown in inches, axle loads in kilograms.

ii. Tare Weight – tractor – 8,810 kg
– lead semitrailer – 6,050
– rear semitrailer – 5,050
19,910 kg

iii. Capacity – lead semitrailer – 32,000 L
– rear semitrailer – 30,000
62,000 L

iv. Payload – 43,590 kg (59,306 L of gasoline)

v. GVW – 63,500 kg

Figure 4.4.2 Hutchinson Industries: 3-S3-S2 Tank

iv. Shell's vehicle is configured to be registered at the maximum GVW in Ontario. To do so, the base length (axle #1-#8) has been set at 758" (19.25 m) versus Imperial Oil's 739".

v. Other differences between this B-train and the one built for Imperial Oil are: (a) lower height (tanks are 75" and overall estimated height for both semitrailers is 142"); (b) lower tare weight (19,910 kg versus 20,825 kg); (c) the semitrailers on the Shell configuration are more equal in length; and (c) the Shell combination has more load at the rear of the vehicle than the Imperial Oil unit (ie, less weight on the steering axle and more weight on the last tandem). The company suggested that one of the consequences of Ontario adopting the 23 m length limit has been to allow Hutchinson Industries to build these train sets "longer and lower" thereby increasing stability. The Shell unit shown here is a more recent design than the Imperial Oil unit; while the tractor length was not given on the drawings, it is quite clear that -- given the wheelbase -- the over-all length of Shell's unit is over 21 m (the old limit).

vi. One final detail to note about the Shell B-train is that the lead semitrailer's group of three axles is not a "triple" axle under Ontario's regulations (the spreads are unequal). At first, this appears to be a disadvantage as a triple axle is allowed a greater load over the same total distance than a "three axle group." In fact, the allowed load for the three axles in Figure 4.4.2 is slightly less than that shown (20,400 kg versus the 20,860 kg shown). When questioned about this, Hutchinson Industries pointed out that Shell had specified a certain type of suspensions that dictated the use of a tandem-plus-a-single rather than a triple axle.

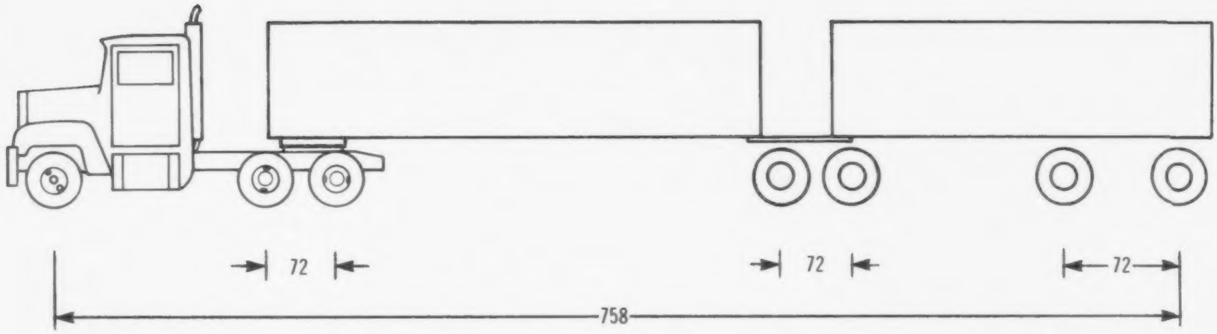
4.4.2 The 7-axle B-train Tanker

No drawings for a 7-axle B-train were obtained. However, it is known that Shell Canada operates such configurations. It is understood that one of the reasons for selecting a 3-S2-S2 instead of a 3-S3-S2 is that the 7-axle combination is easier on pavements in the retail dealers yards. Further, some people (not Hutchinson Industries) claim that Shell's 7-axle B-train has a higher payload than Imperial Oil's 8-axle B-train. Whatever the complete reason for selecting a 7-axle B-train, Figure 4.4.3 has been prepared to see what one might look like. As shown, it is theoretically possible for a 7-axle B-train to have a larger payload than some 8-axle B-trains. Note that:

i. The assumed tare weight is based on the 8-axle Shell B-train minus 950 kg for one less axle (950 kg is the difference in weight between the 3-axle group and the semitrailer tandem axle shown in Figure 4.4.2).

ii. The only dimensions shown in Figure 4.4.3 are those that are critical for a GVW of 62,100 kg (ie, a base length of 19.25 m and 72" tandems -- which could actually be somewhat smaller than this).

iii. With respect to the front-axle load, this has been chosen in order to put the combination into the range of being allowed 62,100 kg in total mass



Tare:	5,500	5,500	3,960	4,000
Payload:	2,000	13,000	15,140	13,000
	7,500	18,500	19,100	17,000

NOTES

i. Dimensions shown in inches, axle loads in kilograms.
ii. Tare Weight – tractor – 8,810 kg
– lead semitrailer – 5,100
– rear semitrailer – 5,050
18,960 kg
iii. Capacity – 59,000 – 60,000 L
iv. Payload – 43,140 kg (58,693 L of gasoline)
v. GVW – 62,100 kg

Figure 4.4.3 Hutchinson Industries: 3-S2-S2 Tank

(note that Imperial Oil has this much on a front axle). Whether or not a tractor hauling two tank semitrailers with a base length of 758 inches could actually load this much on the front axle is not known. (Note that if it were possible to put another 500 kg on the front axle, this 7-axle B-train would have almost the same payload as the 8-axle shown in Figure 4.4.2.)

iv. Another fact not known, and the reason this is a hypothetical configuration, is whether or not the semitrailers, kingpins, fifth wheels, etc. could be arranged in such a manner that the load would be distributed over the tandem axles as shown.

Whether or not the 7-axle B-train shown in Figure 4.4.3 is possible, the point is that a 7-axle unit can carry almost as much as, and in some cases possible more than an 8-axle unit. When questioned about this point, Hutchinson Industry's response was: "Although it is possible, other desirable parameters, such as low over-all height, would be sacrificed. The locations of centres of gravity and axle groups make the weight distribution difficult to achieve."

4.4.3 The 7-axle (48' quad-axle) Tanker

Another consequence of the adoption of 23 m length limits and the concurrent adoption of 48 foot trailers is that tractor-semitrailers can now haul about the same as the B-trains. In fact, in current Hutchinson Industries advertisements the text reads:

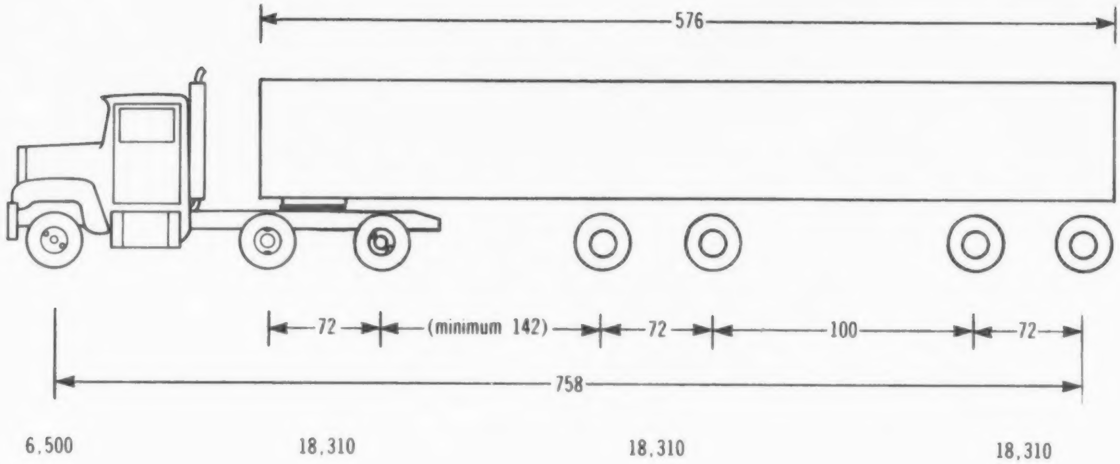
> *"Ontario's new longer lengths allows 58,000 litres of Class I petroleum products to be hauled in a single aluminum tank. Competitive in capacity with a train it has some advantages including lower capital costs and the ease with which it can be backed up."*

The drawing in Figure 4.4.4 is based on a rough interpretation of a design Hutchinson Industries did for Tudhope Cartage -- the dimensions shown are only those (minimum) dimension required for a GVW of 61,300 kg. A few other points to note about this configuration are as follows:

i. All else equal (number of compartments, valves, etc.) a 4-axle semitrailer configuration is about $15,000 cheaper than a train set.

ii. It is unlikely that this configuration could replace trains entirely as they are difficult to manoeuver within some retail situations. They are probably of most use on the longer intercity hauls and on hauls to larger consignees.

iii. Presumably, Quebec's recent decision to special permit quad axles will encourage the adoption of these configurations in both Ontario and Quebec.


576
72
(minimum 142)
72
100
72
758
6,500
18,310
18,310
18,310

NOTES

i. Dimensions shown in inches, axle loads in kilograms.
ii. Tare Weight – tractor – 9,000 kg
– semitrailer – 9,600
18,600 kg
iii. Capacity – 58,000 + L
iv. Payload – 42,630 kg
v. GVW – 61,230 kg (legal up to 61,300 kg)

Figure 4.4.4 Hutchinson Industries: 3-S4 Tank

4.5 INTER-COUNTY MILK TRANSPORT LTD.

Inter-County Milk Transport in Arthur Ontario operates about 17 power units. Most of the operation involves picking up milk from farms and delivering it to a number of dairies (most in the Toronto area about 100 km away). In addition, the firm operates one flatbed semitrailer on a trip load basis (to points as far as Texas), van semitrailers (eggs), and some special semitrailers designed to haul tree bark. For here, the interest is in only the milk-hauling aspect of the business.

There are three basic linehaul configurations used as shown in Figure 4.5.1 -- a 9-axle A-train (3-S2-4), a 7-axle truck-plus-trailer (3-4), and a 6-axle tractor-semitrailer (3-S3) where the semitrailer is a 45 foot with an air-lift belly axle. The 3-4 and the 3-S3 are also shown in Figure 4.5.2, and a 3-S2-4 in the process of being assembled is shown in Figure 4.5.3. Some points to note about this equipment and these configurations are:

i. All tanks are double-walled stainless steel (there is about a 4" gap between the walls for insulation).

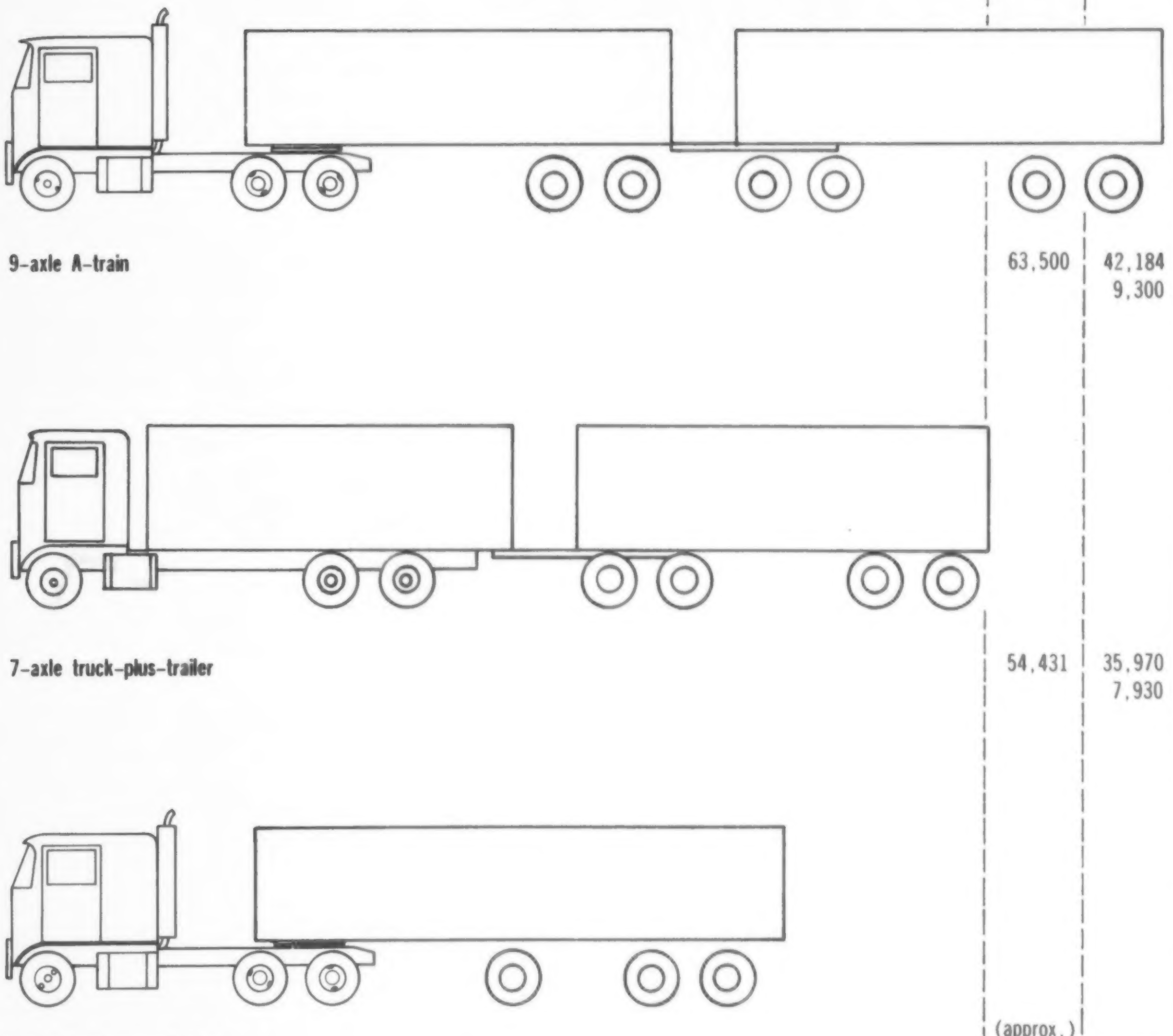
ii. There are a few aspects about this equipment that differ from other liquid tank operations: (a) the operation is closely regulated (tank design, cleaning procedures, the temperature of the milk when picked up, licensing drivers as inspectors, etc.); (b) the tanks on the semitrailers have to be rebuilt about every six years as the condensation created when hauling milk causes rusting problems in the cradle; (c) the centres of gravity appeared high on these tanks, but apparently this is necessary to obtain the clearances required in some of the yards they operate.

iii. The tractor-semitrailer -- that is, the semitrailer shown in the 3-S3 configuration -- is only used for linehaul operations, as it is too large to operate in farmers' yards.

iv. Both the A-train and the truck-plus-trailer are used during the day to make pickups from farms (roughly 17 pickups per unit). In the case of both the A-train and the truck-plus-trailer, the second tank is unhooked, the tandem-axle dolly removed and another tractor is used (generally an older tractor) with the second trailer. These are 31 foot semitrailers costing approximately $56,000 to $60,000 each.

v. All tandem spreads on the A-train and the truck-plus-trailer are 48 inches: wider spreads are not required for GVW, and wider spreads are difficult to operate in farmer's yards where they disturb the ground.

vi. In terms of the relative advantages of using one or another of the three configurations shown, the following facts and opinions were developed during the interview: (a) the A-train has clearly the largest payload and offers considerable flexibility in that both tanks can be used during the day for pickups; (b) also, the A-train and the truck-plus-trailer are more flexible than the tractor-semitrailer when delivering to dairies in that the pup (on the few occasions when required) can be dropped at one dairy



	GVW (kg)	Payload (kg) (gallons)
9-axle A-train	63,500	42,184 9,300
7-axle truck-plus-trailer	54,431	35,970 7,930
6-axle tractor-semitrailer	(approx.) 55,000	36,287 8,000

Figure 4.5.1 Inter-County Milk Transport: Configurations

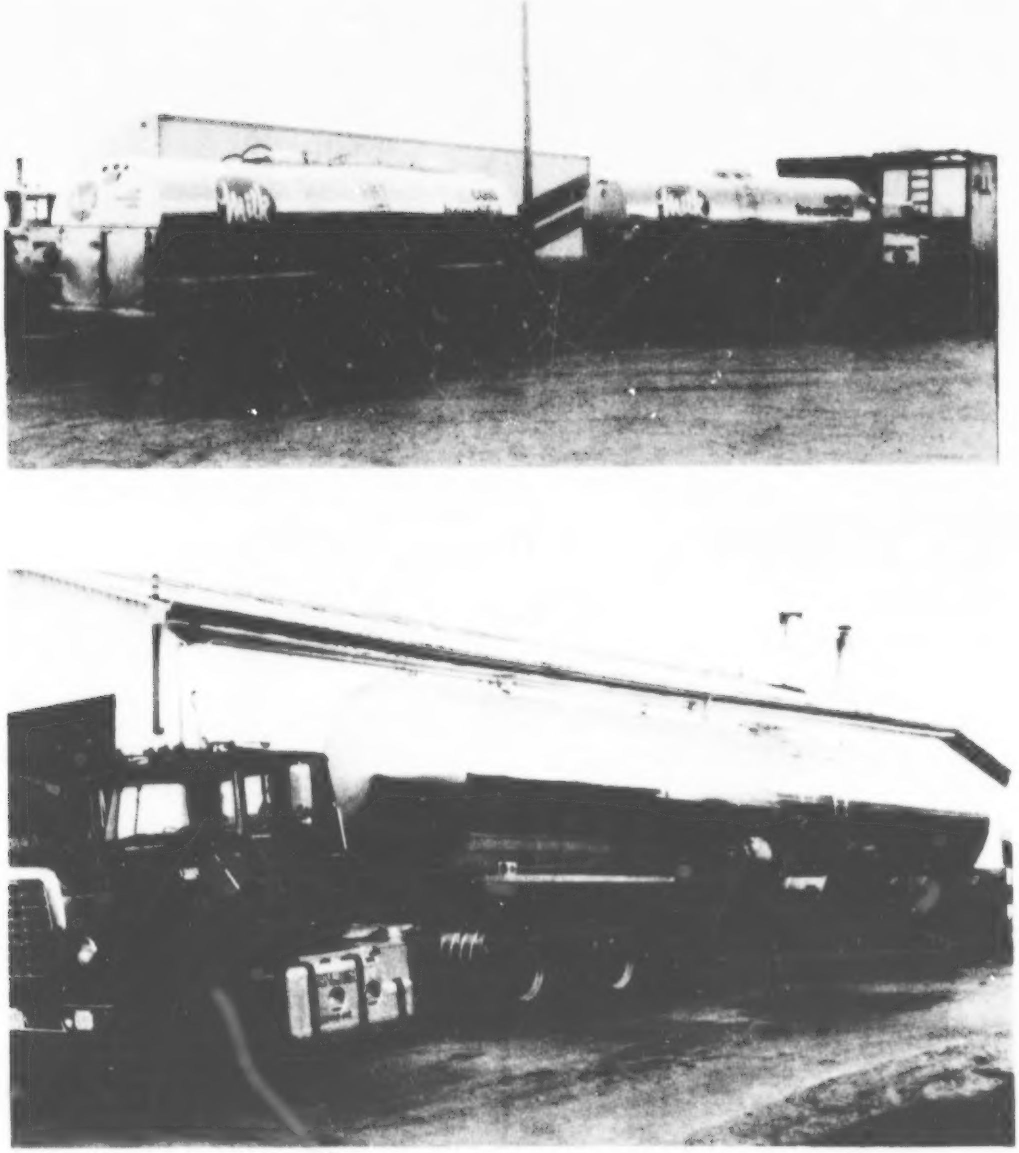


Figure 4.5.2 Inter-County Milk Transport: 3-4 & 3-S3

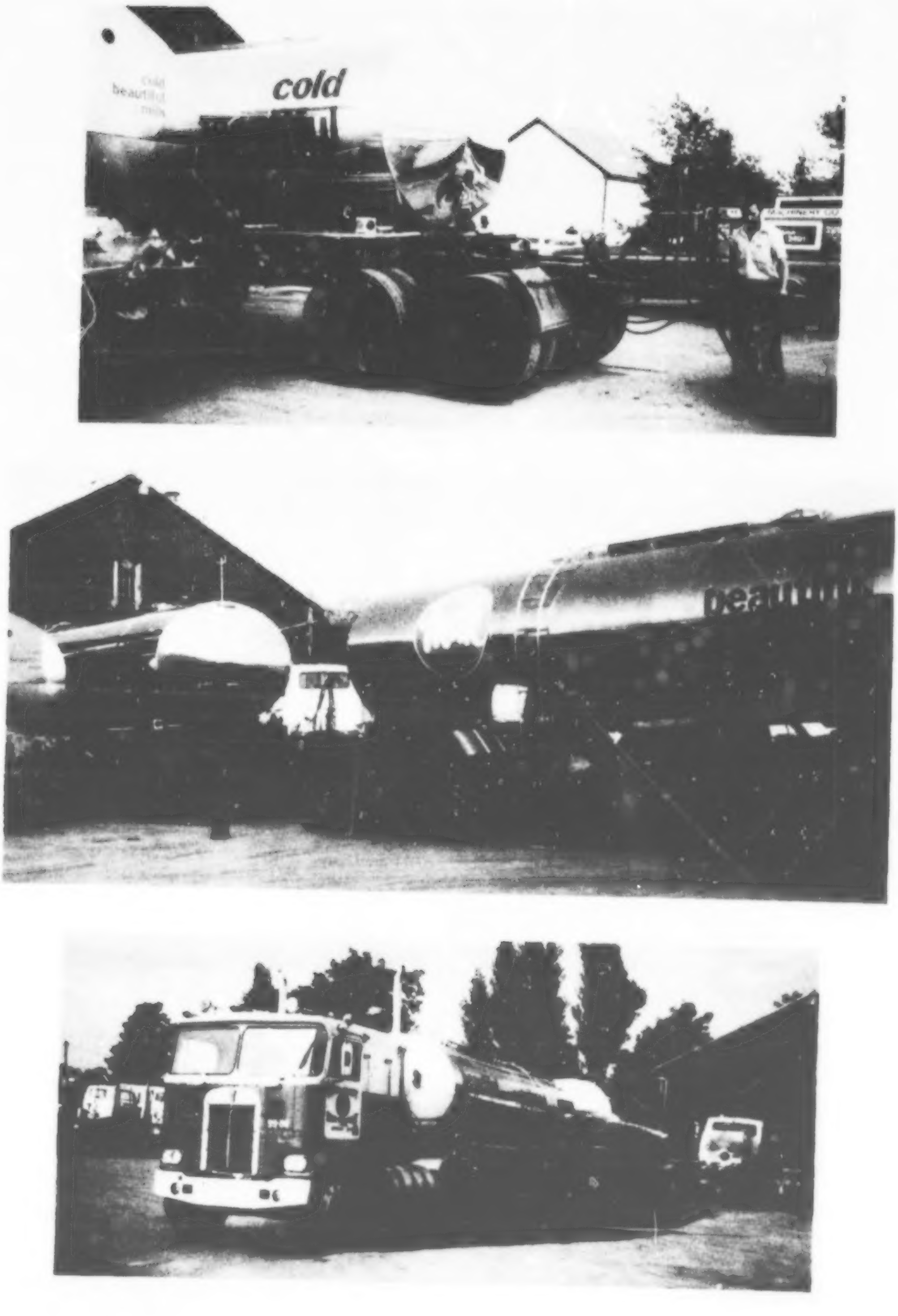

cold
beautiful
milk
cold
MACHINERY CO

Figure 4.5.3 Inter-County Milk Transport: Assembling the 3-S2-4

while the lead unit delivers to another dairy (the Milk Marketing Board controls deliveries as well as rates); (c) presumably countering the advantages of the A-train somewhat is the high capital cost -- with a $90,000 tractor, the configuration shown in Figure 4.5.1 has a replacement cost of about $210,000; (d) the truck-plus-trailer has a smaller payload than the A-train but presumably is somewhat more maneuverable (in farmers' yards) and has a lower capital cost; (e) in addition (and although no hard opinions were expressed) the truck-plus-trailer has only two articulation points compared to the A-train's three, offering one would think somewhat more stability; (f) the tractor-semitrailer is a fairly efficient unit in many bulk hauling situations (ie, high payload per axle and presumably high payload per dollar of capital cost); however, in this case Inter-County Milk has some doubts about the usefulness of the unit -- in particular, the transfer of milk from the pickup units and the subsequent cleaning of the pickup unit's tanks require several more hours of work at the Arthur terminal (in the case of the A-train and the truck-plus-trailer, there is no transfer at Arthur, and the tanks are cleaned at the dairies upon delivery); and (g) there were some reservations expressed about the costs of operating the tractor-semitrailer (in comparison to the other two) as it was felt that tire wear was a problem on the lift axle.

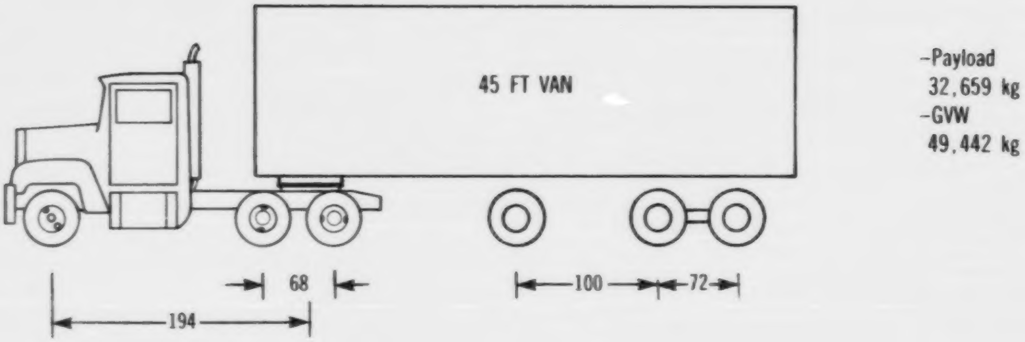
4.6 LABATT'S ONTARIO BREWERIES

Labatt's operates about 100 trailers and 55 tractors delivering beer to retail outlets in Ontario. (The high ratio of trailers to tractors is necessary to optimize trailer loading.) A variety of configurations are used including some older 5-axle tractor-semitrailers (3-S2's) where delivery conditions are such that the newer large loads either cannot get in (manoeuvering space at the retail point) or the retail store cannot take large deliveries. The two most modern components of Labatt's fleet are shown in Figure 4.6.1. Some points to note about this equipment are:

i. The 6-axle tractor-semitrailer (3-S3) was the largest configuration in the fleet until Ontario introduced 48 feet semitrailers and 23 m lengths. Its payload was 24 pallets at 3,000 lb per pallet (72,000 lbs. or 32,659 kg).

ii. Over the last few years, all of Labatt's newest equipment is 4-axle semitrailers (48' in length) shown in Figure 4.6.2. Initially, the addition of three feet in trailer length presented the industry with some problems as there was no way of adding more pallets in the additional space (the pallets are 48 X 42 inches, however, with cases of beer they measure 50 X 43 inches). With some adjustments to the manner of stacking pallets, they can now load these 48' semitrailers with 26 pallets weighing 3,300 pounds each -- total payload of 85,800 lbs. (38,918 kg).

iii. With respect to the 7-axle configuration, the first two axles on the semitrailer are air-lift axles with dual tires. Labatt's has tried super-singles on these axles (16.5 and/or 18 inches) -- in fact, the picture in Figure 4.6.2 shows super singles on these axles, however, some problems of occasionally being over-loaded at the scales has convinced them to revert to dual tires. The rear tandem on the semitrailer does use super-single tires. The


45 FT VAN
-Payload
32,659 kg
-GVW
49,442 kg
68
194
100
72

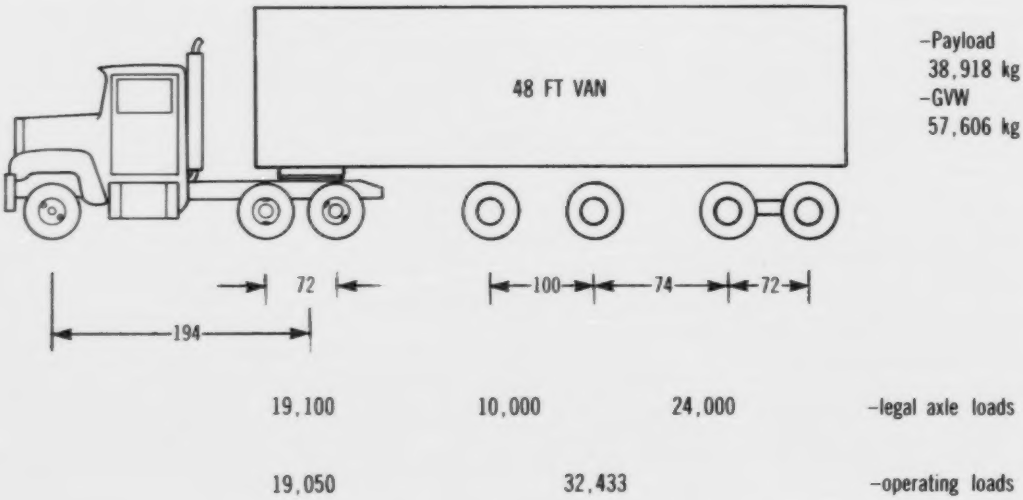

48 FT VAN
-Payload
38,918 kg
-GVW
57,606 kg
72
194
100
74
72
19,100
10,000
24,000
-legal axle loads
19,050
32,433
-operating loads

Figure 4.6.1 Labatt's (Ontario): 3-S3 & 3-S4

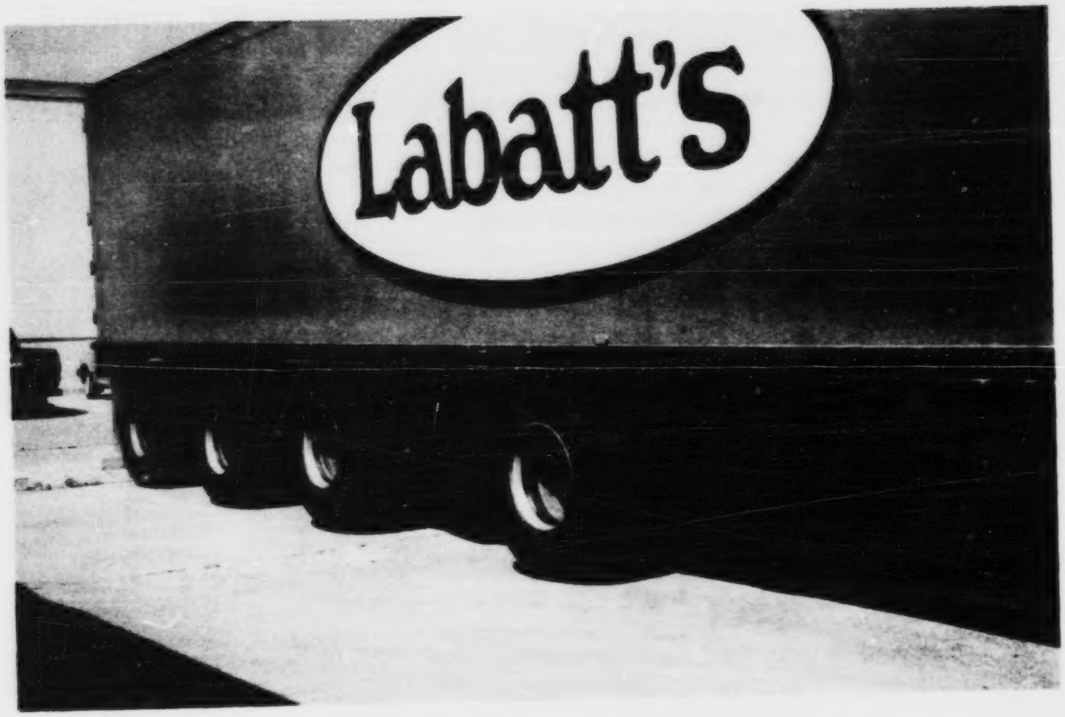


Figure 4.6.2 Labatt's (Ontario): 4-Axle Semitrailer

preference given for these tires is that two of these tires cost the same as four regular (11") tires, but they have a longer life (150,000-175,000 miles) and they improve fuel consumption marginally.

iv. In terms of the legal axle weights shown for the 7-axle unit, there is one oddity about Ontario's regulations. Single axles, tandem axles ("dual" in Ontario's terms), and triple axles are all penalized slightly in terms of allowed loads if single tires are used instead of dual tires (eg, a single axle is only allowed 9,000 kg with single tires versus 10,000 kg with dual tires). Two, three, and four-axle groups, on the other hand, are not penalized in this manner. In the present case, the allowed load on the rear tandem axles (72" spread) is 18,000 kg (instead of 19,100 kg). However, as the last three axles constitute a 3-axle group under Ontario's regulations (the 74" spread would have to be 100" before these axles would be treated independently), the allowed load on the last three axles combined is 24,000 kg. This allowed load of 24,000 kg is independent of the fact that single tires are used on two of the three axles.

v. In terms of payload, it is evident that Labatt's could get considerably higher payloads on 7-axle equipment (easily another 4,000 kg). The reason it does not has to do with the height of the pallets. These pallets are now loaded nine cases high. It is feasible to load ten high (a quick calculation suggests this would add about 4,300 kg to payload); the reason this is not done is that the retail stores are only designed to take pallets with nine cases in height.

vi. In terms of other operating statistics on the 7-axle units, the combinations as shown have a replacement cost of roughly $140,000, the 400 hp tractors average about 70,000 miles annually, the trailers average about 35,000-40,000 miles, the trailers are FRP because of the high inside cube offered (99.5" widths), and the trailers have an over-all height of 12.5 feet which is more than is required but the extra height allows for the operation of fork lift trucks.

vii. Finally, and although specific details have not been obtained, Labatt's is operating 8-axle B-trains in B.C. (3-S3-S2, with a belly axle rather than a triple on the first semitrailer -- see the B.C. regulations), and Molson's is operating some 8-axle B-trains in Ontario (3-S3-S2, with a triple axle on the first semitrailer). With respect to these Ontario units of Molson's, it is understood that their method of resolving the loading/unloading difficulties is to use a "load-through" method whereby the first semitrailer's rear door opens and the second semitrailer's front door also opens, thereby permitting a fork lift to drive straight through both semitrailers.

4.7 MAKSTEEL SERVICE CENTRE

Maksteel operates a large plant in Mississauga and serves the Canadian market from this location (ie, buys steel from the mills and delivers it, after modifications, to manufacturers across the country). As service is important in this industry, Maksteel has a large fleet of combination trucks (probably well over 100 power units). While many aspects of this fleet are of interest, details on only two operations are discussed here. To operate from Ontario to Western Canada, Maksteel runs a number of configurations -- in particular, an 8-axle B-train shown in Figure 4.7.1 and an 8-axle C-train shown in Figure 4.7.2

Many of the details shown in Figure 4.7.1 are estimates as actual loads vary. Nevertheless, the point about the measurements shown in Figure 4.7.1 is that they "work" in terms of Ontario's and Manitoba's regulations:

i. In Step 1 as shown in Figure 4.7.1, the B-train is loaded to the maximum Ontario limit (of 63,500 kg) with a payload of about 85,000 lbs.

ii. In Step 2, the combination has reached the Manitoba border (West Hawk) and with the pup trailer unhooked, the axle loads might look like those shown in Figure 4.7.1. The problem with this tractor-semitrailer configuration in terms of Manitoba's regulations are: (a) too much load on the front steering axle (although this is a contentious point*); (b) too much load on the drive tandems (16,000 kg is the maximum); (c) too little distance between the drive and the trailer tandems (if the spacing is less than 5.0 m, the regulations require a reduction of 330 kg per 0.1 m).

iii. To run the tractor-semitrailer into Winnipeg, Maksteel moves the semitrailer kingpin forward 30 inches (thereby moving the semitrailer 30 inches back and taking load off the front-steering and drive-tandem axles), and raises the air lift axle (axle #4). The photograph in the top of Figure 4.7.4 shows the B-train in this position. In Winnipeg, some of the load is delivered (say 15,000 lbs.) and the tractor bobtails back out to the West Hawk scale.

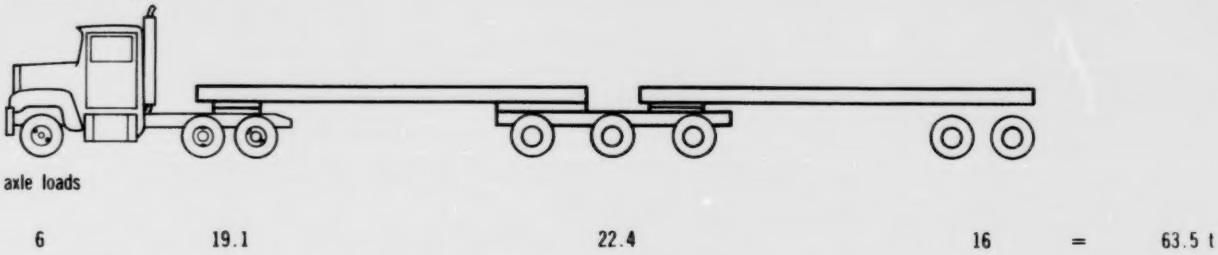
iv. Once back at West Hawk, the tractor picks up the second semitrailer as shown in Step 4. In this case, to comply with the Manitoba regulations, Maksteel has built these semitrailers such that the tandem axles slide backwards a sufficient distance to achieve the 5 m spacing between axles #3 and #5. Again, the (now 3-S2) runs into Winnipeg and drops some more load.

v. At this point (Step 5), the two semitrailers are re-joined into the conventional Western B-train double configuration. The 3-S2-S2 proceeds on westward (Saskatchewan, Alberta) with: (a) the kingpin on the lead semitrailer in its 30" forward position, (b) the air lift axle raised, and (c) the rear tandems extended.

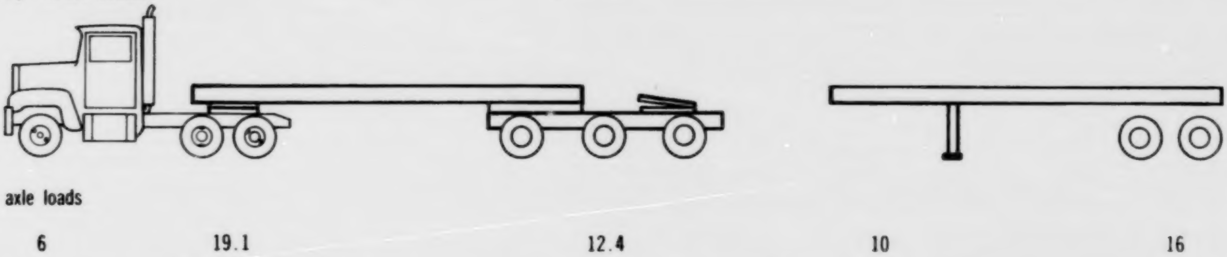
---

* *Technically, Manitoba's regulations permit up to 8,190 kg on front steering axles as long as axle is rated for this load (and manufacturer's certificate or suitable proof carried with the vehicle). However, various carriers claim vigorously that they cannot get by the West scale with any more than 5,500 kg on the front axle. In the present case, the Maksteel combination must have at least 13 inch tires on the front (with 7,000 kg on the front axle, 13 inches or rubber is required to meet Ontario's 11 kg/mm requirement). If indeed the unit does have 13 inch tires, Manitoba's regulations would allow 5,940 kg (ie, 9 kg/mm), which is so close to 5,500 kg that it is assumed this is what this particular vehicle would be allowed.*

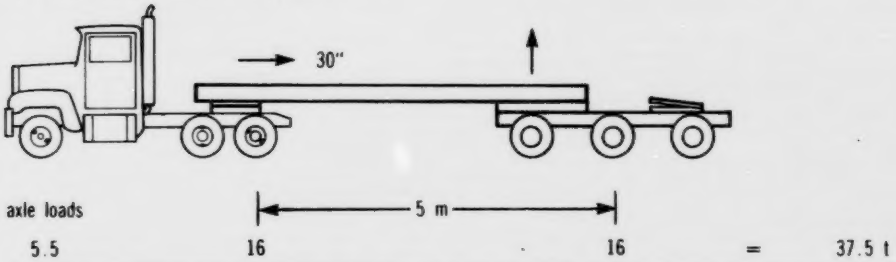
1) LEAVE SOUTHERN ONTARIO


axle loads
6
19.1
22.4
16
=
63.5 t

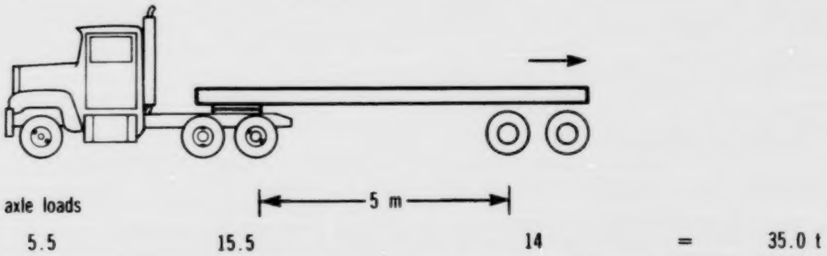
2) WEST HAWK


axle loads
6
19.1
12.4
10
16

3) INTO WINNIPEG WITH 1ST SEMITRAILER


30"
axle loads
5 m
5.5
16
16
=
37.5 t

4) INTO WINNIPEG WITH 2ND SEMITRAILER


axle loads
5 m
5.5
15.5
14
=
35.0 t

5) RE-COMBINES UNIT AS WESTERN B-TRAIN

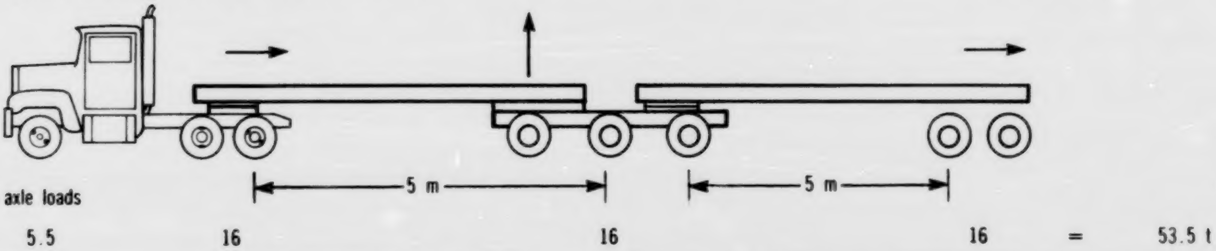

axle loads
5 m
5 m
5.5
16
16
16
=
53.5 t

Figure 4.7.1 Maksteel: 3-S3-S2 Running Ontario — West

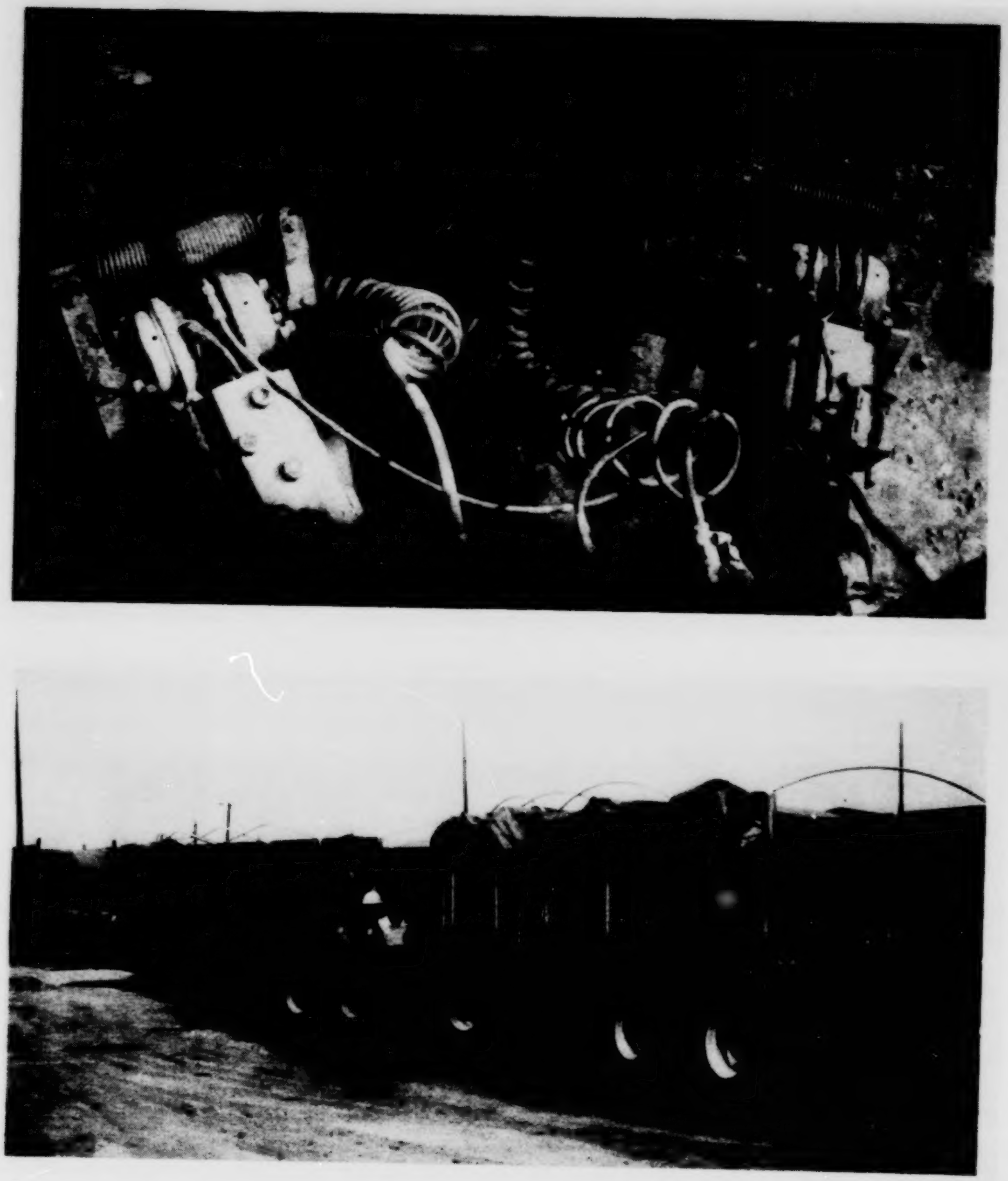


Figure 4.7.2 Maksteel: C-train (3-S2-3)

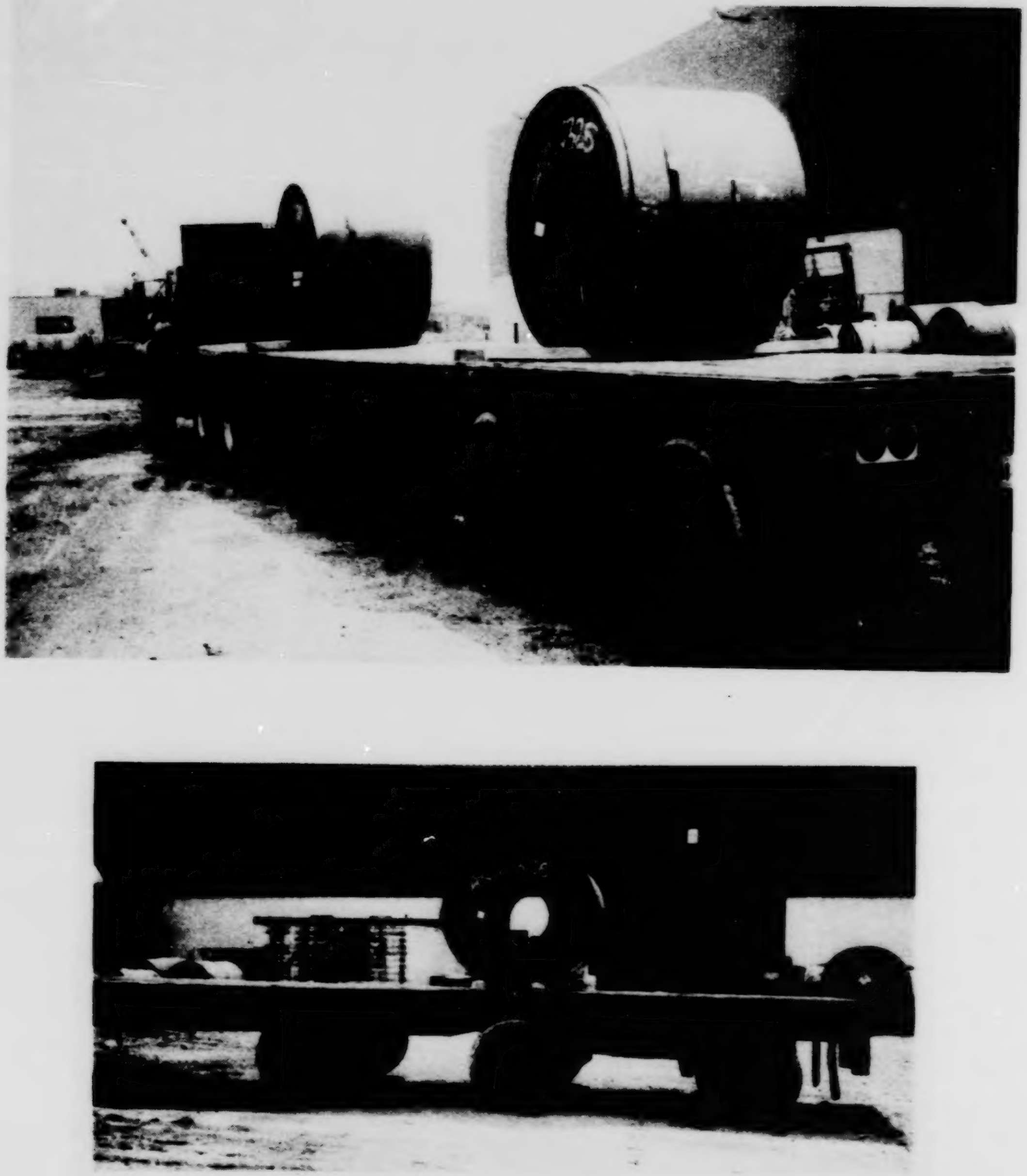


Figure 4.7.3 Maksteel: 3-S3

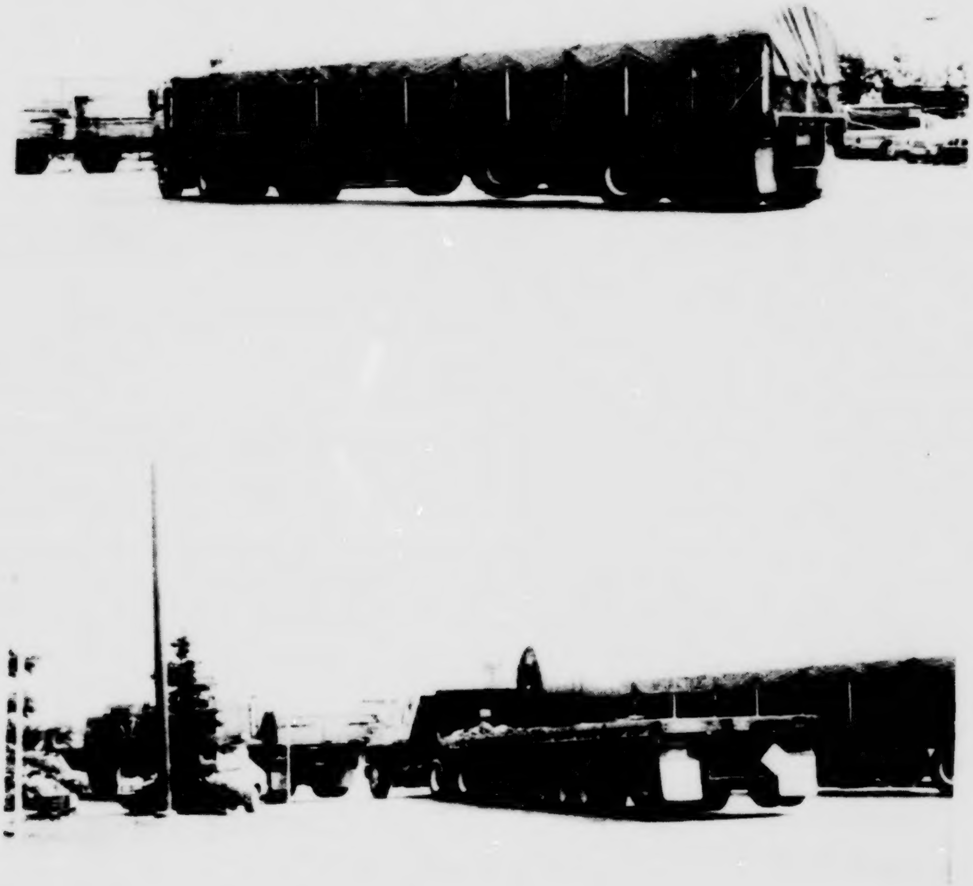


Figure 4.7.4 Maksteel: 3-S4 & 3-S5

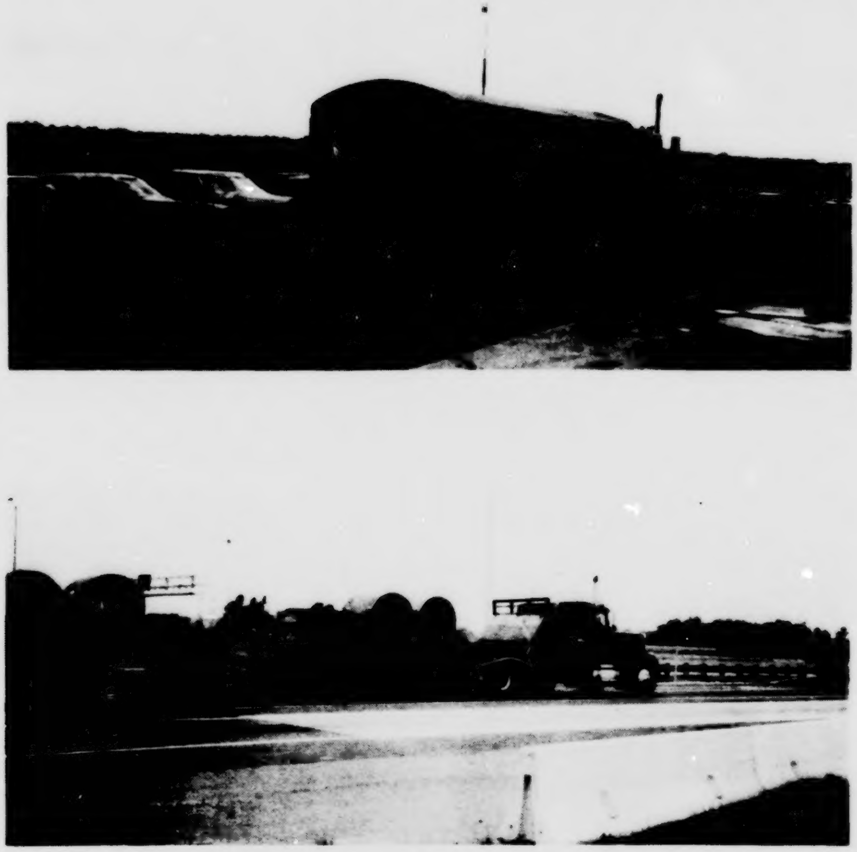


Figure 4.7.5 Maksteel B-train & Steel Hauler 3-S3-3

vi. The cost of making these modification to the B-train, enabling an Ontario 3-S3-S2 at 63,500 kg to be converted to a 3-S2-S2 at 53,500 kg with Prairie spacings, is in the order of $15,000.

Details on just how the 8-axle C-train operates at the Ontario- Manitoba border are not known. However, the operation is similar to that shown for the B-train in that the unit leaves Southern Ontario at or close to the Ontario GVW limit and then drops one pup at the Ontario border. In this case, the unit can operate in Manitoba at 56,500 kg. In Figure 4.7.2, the top picture is a top view of the C-train dolly.

Other pictures of configurations hauling steel are shown in Figure 4.7.3 -- the point of this one being the critical placement of the rolls on the trailer to distribute the load properly over the axles, Figure 4.7.4 -- 7- and 8-axle tractor semitrailers used within Ontario, and Figure 4.7.5 -- the B-train used on Western hauls and a 9-axle A-train.

4.8 MANITOULIN TRANSPORT INC.

Manitoulin Transport's "Supertruck" is a unique design which shows the flexibility of Ontario's regulations in the face of special transportation operations. As far as is known, this is the largest truck in Canada -- in terms of available trailer cube (outside measurements of 66'4" and a total cube of approximately 4,737 ft.3) within the standard weight and dimension regulations (ie, excluding special permit doubles and triples). Precise dimensions are shown in Figure 4.8.1 and further pictures are contained in Figure 4.8.2.

Aspects of the "Supertruck" to note include the following:

i. The drome is insulated with heating ducts in the floor, and a door for loading on both the side and the rear.

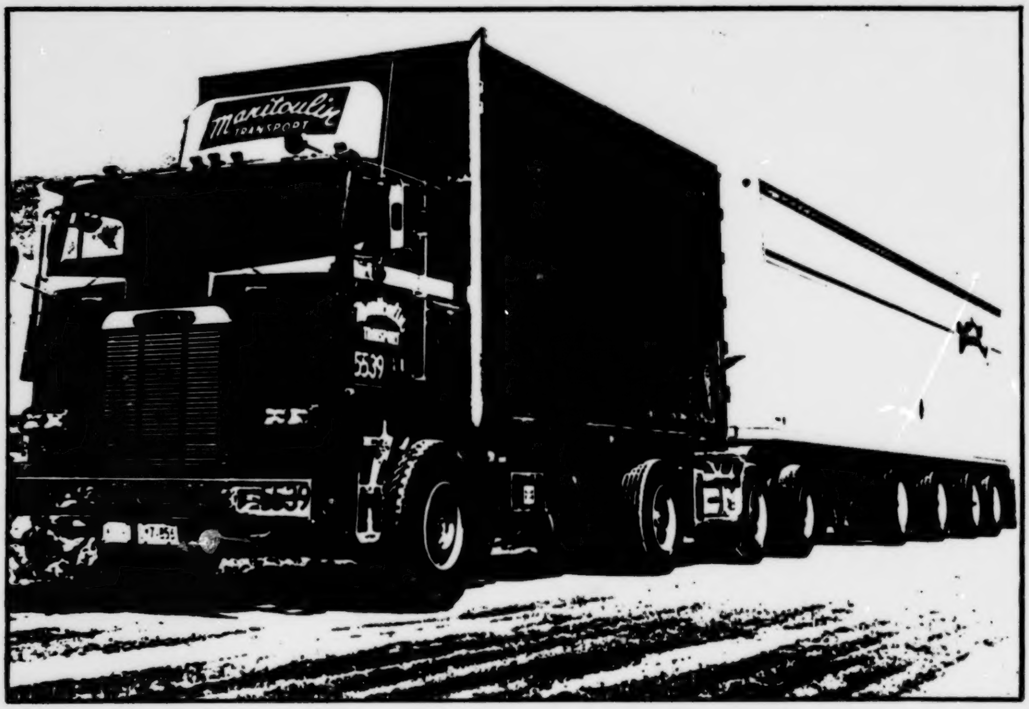
ii. The semitrailer is a rack and tarp; each unit has a special rack-stacking pallet which can be loaded into the drome or left at the terminal when flatdeck equipment is required.

iii. The tare weight is high: 28,700 lbs. for the tractor, and 25,000 lbs. for the semitrailer, for a combined tare weight of 53,700 lbs. (24,358 kg). With a 138,700 (62,914 kg) GVW, this leaves 85,000 lbs. (38,555 kg) for payload.

iv. Axles #2, #5, and #6 are air-lift axles with super-single tires (18 X 22.5). Super-single tires are also used on the front-steering axles and the rear tandem on the semitrailer (axle #7 and #8).

v. The large front-axle setback (60") is required to ensure high front-axle loadings.

vi. Use of the Supertruck has required some modifications to dock designs -- see Figure 4.8.2. At the main terminals, the dock actually overhangs the yard in order to allow the tractor tandems to back under the dock -- thereby allowing the drome to meet the dock floor.


Manitoulin
TRANSPORT
5539

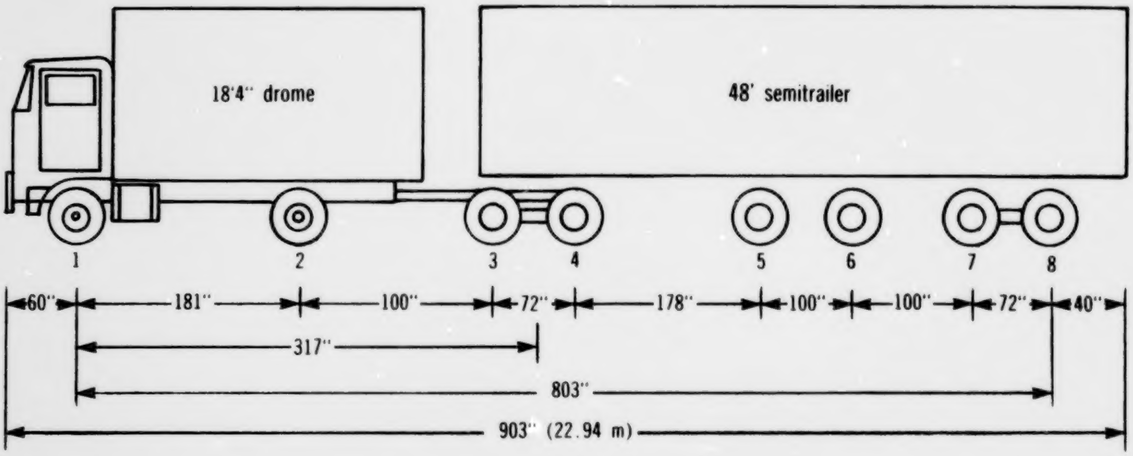

18'4" drome
48' semitrailer
1
2
3
4
5
6
7
8
60"
181"
100"
72"
178"
100"
100"
72"
40"
317"
803"
903" (22.94 m)

Figure 4.8.1 Manitoulin Transport Inc.: "Supertruck"

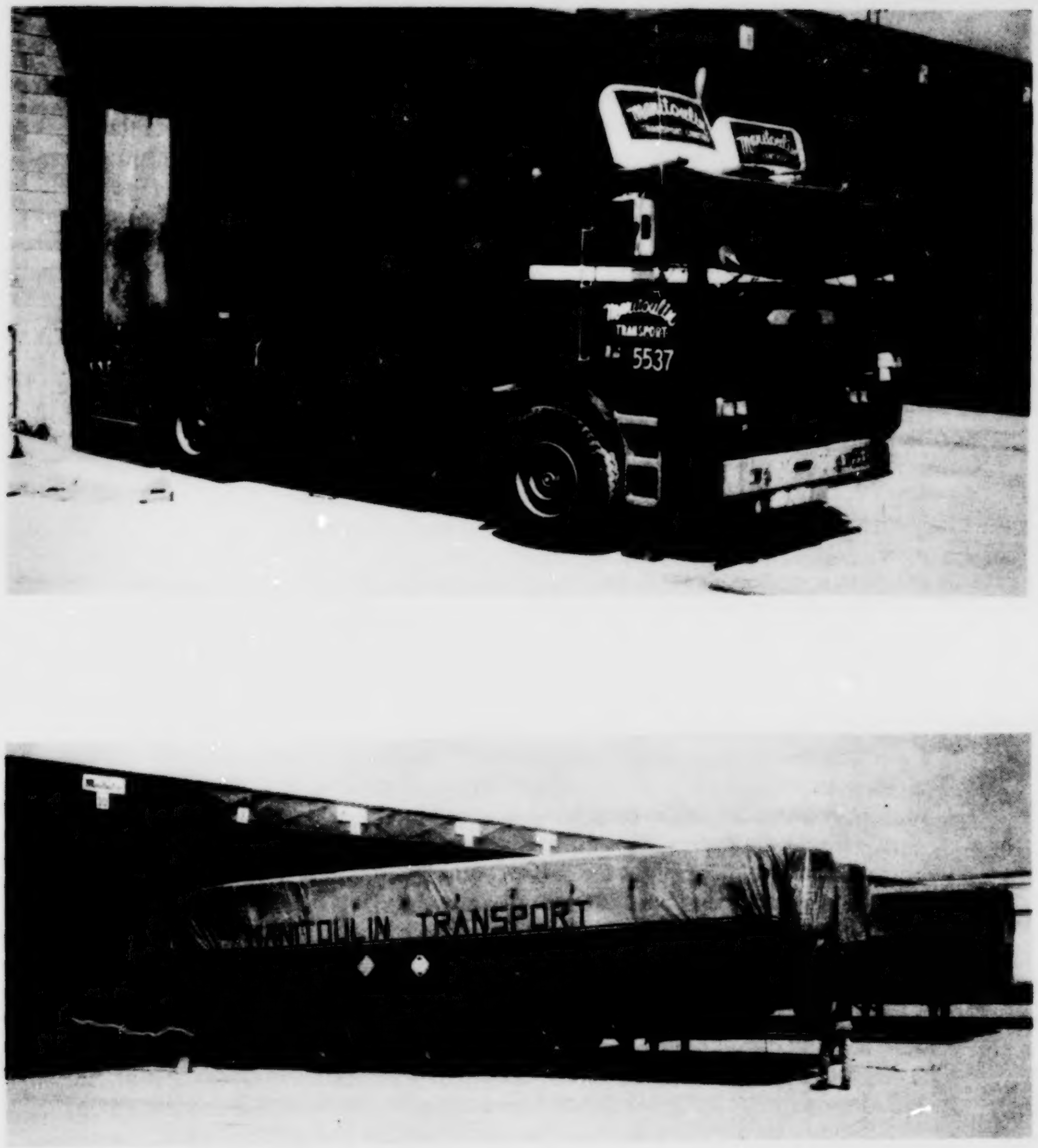

Manitoulin
TRANSPORT
5537
MANITOULIN TRANSPORT

Figure 4.8.2 Manitoulin Transport Inc.: "Supertruck" at Dock

vii. The combination is valued at roughly $160,000.

Manitoulin has developed this particular configuration because of the different types of freight it hauls northbound, within the north, and southbound: LTL general freight moves from the Toronto/Hamilton area into Northern Ontario -- these loads are light, averaging 25,000 lbs. on a 48' semitrailer; TL loads of steel, lumber, paper, etc. move southbound -- these loads vary from 45,000-85,000 lbs. depending on the commodity.

Of the northbound LTL freight, approximately 5% requires heat in the winter months. To serve its 14 Northern Ontario terminals with a daily overnight service, the company has to use insulated vans for this perishable freight. However, insulated vans are difficult to load with the southbound TL freight. The solution the company adopted was the supertruck which combined both the insulated-van and the rack and tarp (or flatdeck) equipment it needed.

In addition, Manitoulin hauls small quantities of general freight between its Northern Ontario terminals as well as from these terminals back to Southern Ontario.

With the Supertruck, Manitoulin can now do the following:

i. On northbound LTL loads, the perishable freight can be loaded in the drome and the non-perishable freight can be loaded in the rack and tarp 48' semitrailer.

ii. The southbound TL freight can be loaded onto the 48' semitrailer in either a tarped or flatdeck manner. If a flatdeck is required (eg, lumber), the racks can be stowed on their pallets in the drome.

iii. The combination can be used to haul the small quantities of LTL general freight between terminals within Northern Ontario. That is, with the northbound LTL freight unloaded, and a semitrailer load of southbound TL freight hooked up, the combination can still accommodated some LTL freight in the drome -- picking it up and/or dropping it off at the various terminals it passes on its southbound trip. When used to haul this intra-Northern Ontario freight, the southbound TL load is limited to 80,000 lbs.

iv. The unit can either be loaded with both the tractor and semitrailer backed up to a dock (as shown in Figure 4.8.2) or, in Northern Ontario, the drome can be loaded/unloaded from the side door with the unit pulled up beside a terminal (ie, without having to unhook the semitrailer).

The first Supertrucks developed by Manitoulin were 3-S4 configurations with 13'6" dromes. These units were difficult to load in a manner that did not overload either the front-steering axle or the tandem-drive axles. The latest Supertrucks, with 4-axle tractors and 18'4" dromes, have not had these problems. With these units, the forward "pusher" axle (axle #2 in Figure 4.8.1) takes a weight of 16,000 lbs. thereby relieving the weight on the front-steering and tandem-drive axles. Even where very heavy LTL freight is loaded into the nose of the semitrailer -- a situation which would give conventional 3-axle tractors a problem of overloads on the drive-tandems -- the Supertruck has no problem keeping its axle loads within the allowed limits.

4.9 MOTOR CARRIERS LIMITED

Motor Carriers Limited (MCL) is a large hauler of new motor vehicles with head quarters in Oshawa (adjacent to the General Motors plant). They have a fleet of 126 tractor-semitrailers with headramps (on the tractor) and semitrailers constructed in a specialized fashion (ie, the decks, ramps, and hydraulics necessary for moving wheeled vehicles).

Points to note about this equipment and this operation are as follows:

i. In terms of weight and dimension regulations, weight is not the issue of concern in this type of trucking operation; they operate well within the maximum GVW limits, and there is no particularly difficult load-distribution problems.

ii. The real issue with this type of trucking is the dimensional aspects of the regulations. All of MCL's equipment operates under annual special permits, allowing it to haul over-height (14'4" versus the standard 13'6"). In terms of width, the trailers are built to 102 inches although they could use a narrower body -- the extra width is considered desireable as it reduces damage to the vehicles (eg, when opening doors). In terms of length, the combinations are limited to the standard 23 m limit, although these type of semitrailers are exempted from Ontario's 14.65 m (48') limit.

iii. This segment of the trucking industry is one of the main forces pushing for longer-combination vehicles. The preferred LCV (for auto-carriers) is 110' B-trains*. During the interview, the issue of the incentive for wanting larger, more productive combinations was raised. The firm has somewhat ambivalent feelings about LCV's as any short-term advantages enjoyed by one trucking company are soon realized by all carriers -- any rate and/or profit advantage is soon reflected in new tariffs. The firm's stated reason for wanting LCV's is as follows: "The number one advantage would be an increase in fuel efficiency and an increase in the safety factor, as less equipment would be required to operate the main corridors of traffic." While these advantages are undoubtedly true, it is speculated that the real incentive for this segment of the industry to adopt larger equipment is with respect to competition with the railways.

iv. The newest components of the fleet carry 11 vehicles; however, there are still many 10-and 9-vehicle carriers in the fleet. The particular number of vehicles that can be carried depends on the size of the vehicles, the make of the vehicle in respect to body style, and truck/car mixes. In Figure 4.9.1, an 11-vehicle picture is shown at the top and a 10-vehicle sketch is shown at the bottom.

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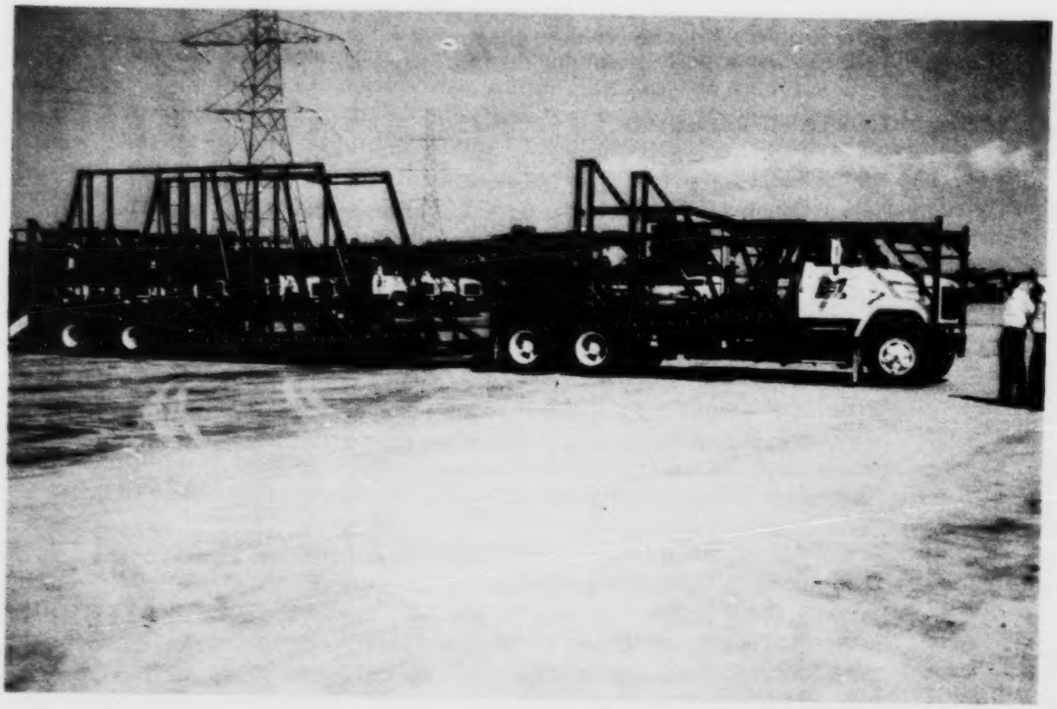
* *One auto carrier, it is understood, is currently operating LCV's on a test basis between Montreal and Quebec City.*



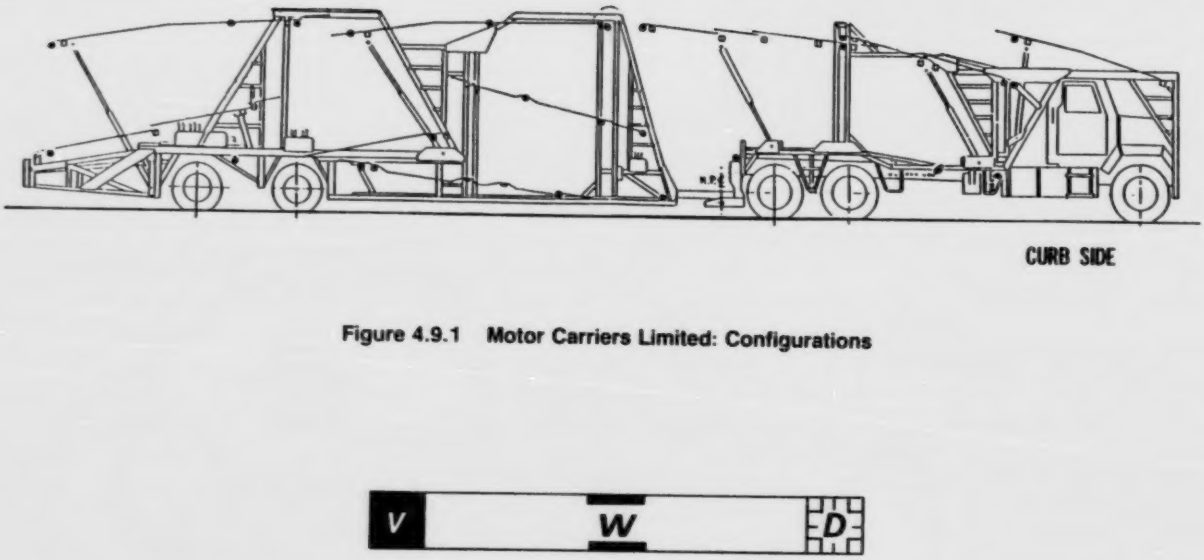


Figure 4.9.1 Motor Carriers Limited: Configurations

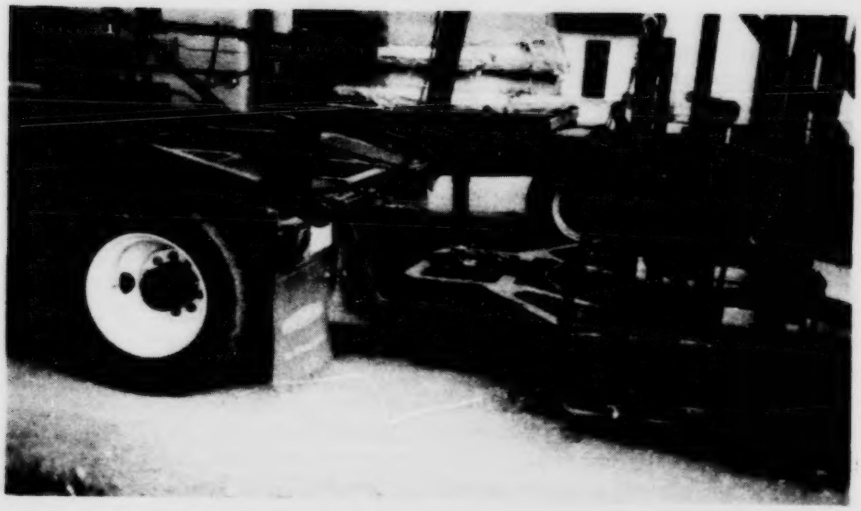


Figure 4.9.2 Automobile Carrier: Stinger 5th Wheel

v. The cost of this equipment is high because of the specialized design (particularly because of the hydraulics); headramp-trailer combinations cost approximately $100,000. The total replacement cost of the tractor-semitrailer is in the range of $165,000-$170,000.

In terms of regulations in jurisdictions in places other than Ontario, several points were raised during the interview:

i. The firm did not start operating 102" equipment until 1982 (when U.S. regulations, the STAA, permitted this width on the interstate system).

ii. In terms of U.S. regulations, MCL currently operates into Michigan and New York. However, these operations are limited to very short hauls on the U.S. side where the load is transferred to an interlining carrier or some unloading depot. It is understood, then, that compliance with U.S. regulations is not an issue.

iii. The railways have most of the traffic on the Ontario-Western Canada lane. MCL does make a few trips for "rush" or emergency loads (during the new-model season, or when some delivery has to be made quickly). For these occasional trips, MCL acquires special permits -- both over-length and over-height -- for its equipment at the Manitoba border. (This is significant as it raises the question of what is an "indivisible load.")

4.10 MARITIME-ONTARIO FREIGHT LINES LTD.

Maritime-Ontario operates between Ontario and the Atlantic. The firm has approximately 100 to 110 power units (all owner-operators) and 250 trailers (roughly 80 to 85 of which are owned by the owner-operators). In terms of the regulatory regime between Ontario and Atlantic Canada, the following points are relevant:

i. The main change (with respect to VWD regulations) that has occurred over the past few years has been the move to (relative) uniformity among Atlantic provinces and the adoption of 48' semitrailers from Ontario to Atlantic Canada.

ii. The 23 m length limit in Ontario and Quebec for tractor-semitrailers is of no consequence on this lane as it has not been adopted by the Atlantic provinces (21 m is the allowed length in Atlantic Canada for tractor-semitrailers).

iii. U.S. regulations are a factor influencing the characteristics of this fleet in that some of the operations involve trips from/to the U.S. This is one of the reasons for the large number of 3-S2 configurations.

Maritime-Ontario's fleet consists almost entirely of 5-and 6-axle tractor-semitrailers, reefer-equipped and typically configured as shown in Figures 4.10.1 and 4.10.2 (this overlooks some larger equipment operating just in Ontario). The axle loads, GVW, and payloads shown are hypothetical based on:

i. Front-axle loads of 5,000 kg have been assumed throughout, except that in the case of P.E.I., 11,000 lbs. has been used in order to follow the Imperial measures in the regulations.

ii. Drive-tandem spreads of 60" and semitrailer tandems of 72" have been assumed (it is understood that these are typical). The remaining axle spacings are shown as "a", "b", "c", and "d" in Figure 4.10.1.

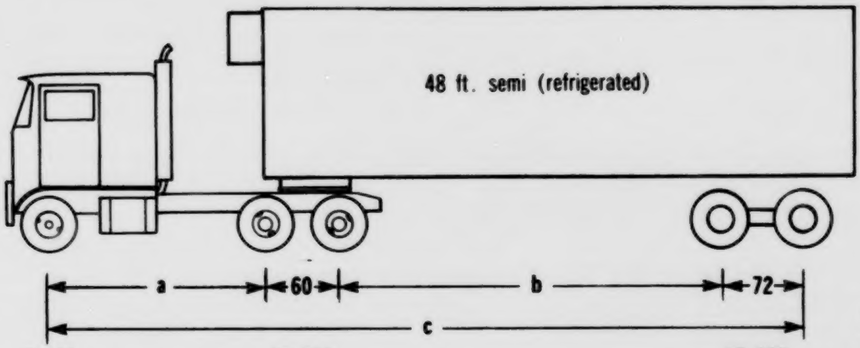
iii. Tare weights of 16,000 kg for the 5-axle tractor-semitrailer and 17,000 kg for the 6-axle tractor-semitrailer have been assumed (bearing in mind the reefers). The payloads shown are the difference between the allowed GVW and these assumed tare weights. In practice, these payloads are high as much of Maritime-Ontario's freight cubes out.

In more detail, the following notes describe the regulations that apply to these configurations:

i. **Ontario**: in terms of the 3-S2, the only way it could register at 42,000 kg (*given* the 5,000 kg front axle), is with an inter-vehicle-unit-distance ("b") of at least 3.6 m (142") and a base length ("c") of at least 11.25 m (443"). For the 3-S3, there are two possibilities (*given* the 5,000 kg front axle) -- either an inter-vehicle-unit-distance of at least 3.3 m (130") and a base length of at least 14.75 m (581"), or an inter-vehicle-unit-distance of at least 3.6 m (142") and a base length of at least 14.5 m (571"). The three axles shown on the semitrailer would have to have at least 2.5 m (100") between the tandem and the single for the single axle to be allowed the full 10,000 single-axle load limit.

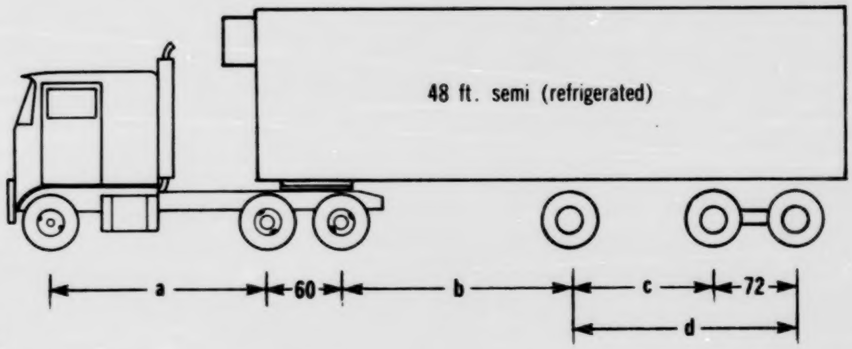
ii. **Quebec**: in terms of the 3-S2 (*given* the axle spreads shown), a combination with a spacing of less than 3 m (118") between axle #3 and #4 would have its GVW reduced from that shown (42,000 kg) at a rate of 450 kg per 0.3 m (or part thereof). For the 3-S3, the outer spread (axle #4-#6) on the tri-axle has to be at least 4.8 m (189") for a loading of 27,000 kg. The axles on the semitrailer would be allowed 30,000 kg if these three axles constituted a "triple" (ie, equal spacing and load sharing within 1,000 kg). This is one area where Ontario and Quebec regulations work in different directions in that if these three axles were a "triple" with an outer spread of 4.8 m, Ontario would allow *less* than the load shown in Figure 4.10.1 (28,600 kg versus 29,100) and Quebec would allow *more* than the load shown (30,000 kg versus 29,000 kg). *Given* the axle loads, the GVW of the 3-S3 is constrained by the spacing of "b" in that anything below 4.5 m (177") would have its GVW reduced by 900 kg per 0.3 m (or part thereof). (***Note that there is at least one aspect of this regulation that requires interpretation and/or confirmation.***)

iii. **New Brunswick**: For both units, New Brunswick would allow the load on the front axle in excess of 4,500 kg to be added to the allowed GVW (given adequate tires and axle ratings). So, in both cases shown, the allowable GVW is simply the sum of the allowed axle weights -- the spacing requirements are absolute in the sense that they must by met (ie,



AXLE LOADS (KG)				GVW	PAYLOAD
Ont:	5,000	17,900	19,100	42,000	26,000
Que:	5,000	18,000	19,000	42,000	26,000
NB:	5,000	17,000	18,000	40,000	24,000
NS:	5,000	17,000	18,000	40,000	24,000
PEI:	4,990	17,010	18,144	40,143	24,143
Nfld:	5,000	17,000	18,000	39,500	23,500

AXLE SPACING (INCHES)	'a'	'b'	'c'
Ont:		142	443
Que:		118	
NB:	118	144	
NS:	118	144	
PEI:	120	144	
Nfld:	120	144	



AXLE LOADS (KG)				GVW	PAYLOAD
Ont:	5,000	17,900	29,100	52,000	35,000
Que:	5,000	18,000	29,000	52,000	35,000
N.B.:	5,000	17,000	27,000	49,000	32,000
N.S.:	5,000	17,000	27,000	49,000	32,000
P.E.I.:	4,990	17,010	27,215	49,215	32,215
Nfld.:	5,000	17,000	27,000	48,500	31,500

AXLE SPACING (INCHES)	'a'	'b'	'c'	'd'
Ont:		130	(if axle #1-#6 = 581)	
		142	(if axle #1-#6 = 571)	
Que:		177		189
NB:	130	167		189
NS:	118	167		191
PEI:	120	168	120	
Nfld:	120	167		189

Figure 4.10.1 Maritime-Ontario: Configurations

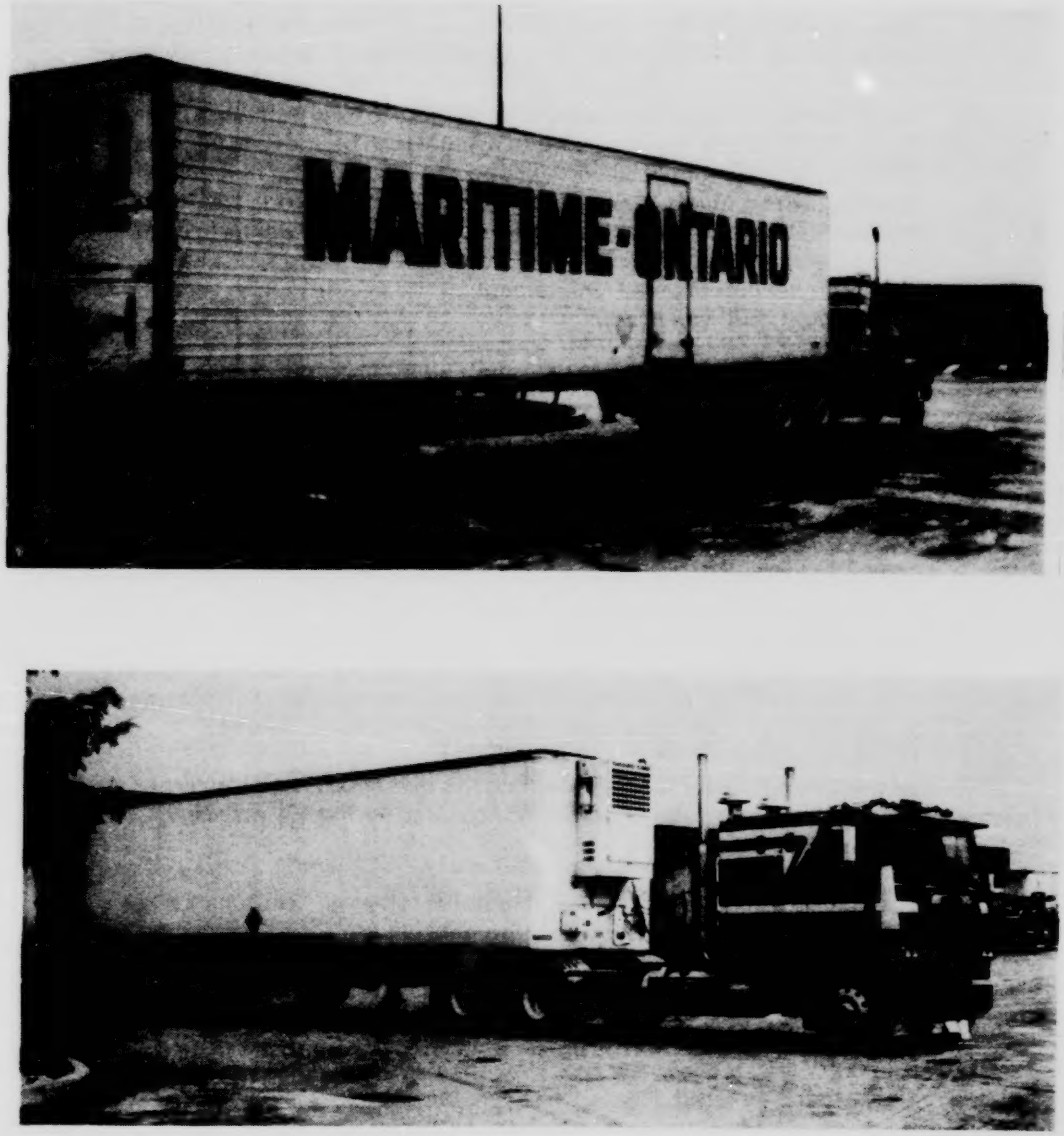

MARITIME-ONTARIO

Figure 4.10.2 Maritime-Ontario: 3-S2 & 3-S3

unlike Quebec or the Prairies, there are no penalties below a certain spacing). The most interesting aspect of the regulations as shown in Figure 4.10.1 is that the spacing between axle #1-#2 increases from 3.0 to 3.3 m (118"-130") for the 3-S3 combination. In other words, the minimum tractor wheelbase that could be used increases from 148 inches for the 5-axle tractor-semitrailer to 160 inches for the 6-axle tractor-semitrailer.

iv. **Nova Scotia**: The regulations are similar to those in New Brunswick. Again, the front axle loads in excess of 4,500 kg can be added to allowed GVW (to the maximum of 50,000 kg); and again the spacing requirements are absolute minimums. One difference between Nova Scotia and New Brunswick is that the tractor wheelbase does not have to change in comparing a 3-S2 with a 3-S3. A further difference is that Nova Scotia has a slightly higher outer-spread requirement for the tri-axle (4.85 m versus 4.8 m in most other provinces).

v. **Prince Edward Island:** The regulations are similar to those in other Atlantic provinces except that they are still written in Imperial measures. These measures have been used in Figure 4.10.1; in practice, it is understood that minor differences would simply be ignored (the differences in axle loads, GVW, and payloads are all small enough to be allowed under official or unofficial tolerances).

vi. **Newfoundland:** Regulations in Newfoundland are similar to those in the other Atlantic provinces, except that it is understood that loads on the front axle in excess of 4,500 kg are not permitted to be added to the allowed GVW. In practice, the 500 kg difference in GVW shown in Figure 4.10.1 in comparing Newfoundland with the other Atlantic provinces may be ignored in as much as tolerance likely allow this much leeway.

One of the interesting questions concerning this operation is why the carrier uses tractor-semitrailers rather than doubles. Points raised during the interview included the following:

i. A double (at 21 m) versus a tractor-semitrailer (given 48' semitrailer's) has only about 6'-7' more trailer space. Note that while it is possible to run two 28' pups within the 21 m length limit and still retain the 16.75 kingpin-to-rear condition, it is difficult -- so the effective trailer space in most doubles is only 54-55 feet. When the "lost" space is accounted for, there really is not that much difference -- ie, two pups with the same length as one semitrailer have less usable loading space than the single semitrailer given the characteristics of most freight.

ii. Two pups require two (roughly $20,000) refrigeration units rather than one, thereby doubling the cost and the possibility that one of them will suffer from mechanical problems.

iii. Operationally, doubles are more difficult than tractor-semitrailers (in terms of backing up, unhooking to load/unload at docks, etc.)

4.11 UNITED VAN LINES

United Van Lines (UVL) is a dispatching organization for member companies (agents). In addition to dispatching, UVL acts as an agent for some trailers (which are sold to agents) and as a supplier of "van equipment" (the large amount of equipment, such as pads, ties, loading ramps, that accompany trailers). The ownership and control of the typical long distance (or interprovincial) household goods truck seen on the road is as follows:

- the tractor is owned by an owner-operator who contracts ("leases-on") with a UVL agent.
- the semitrailer is owned by a UVL agent.
- the tractor-semitrailer (those assigned to UVL's service fleet) are dispatched by UVL. All billing is handled by UVL, and the agent and owner-operator receive commissions for performing certain tasks.
- the owner-operator is generally responsible for all linehaul operations and the loading and unloading of each shipment (ie, the owner-operator will usually hire his own helpers).

To understand the relationship between VWD regulations and the household goods movers' fleet, there are several unique aspects of household goods operations:

i. Unlike most trucking operations, the fleet has to be configured so that it can operate in all Canadian jurisdictions (and to some extent) U.S. jurisdictions. For some agents or some van lines, there may be regional exceptions to this. For example, someone in Atlantic Canada may have a few combinations configured for and only operating in the Atlantic provinces or possibly the Atlantic provinces and Quebec.

ii. The commodity being handled is light density -- most shipments being in the range of 112 to 128 kg/m3 (7 to 8 lbs./ft.3). This can vary considerably from one type of shipper to another (*"preachers with all their books. . ." was the example given*). Also, and of some significance to trailer design over the last decade, household goods movers are increasingly in the business of moving automobiles.

iii. While a light density commodity is an ideal candidate for double-trailer configurations, these are not used by the industry. The reason has to do with the operational aspects of the industry. Briefly, the driver (an owner-operators) is in control of and responsible for the load (ie, he has to pay for either all or some part of any claims). Therefore, a driver cannot simply drop his second trailer and have someone else load or unload it for him.

4.11.1 Fleet - General

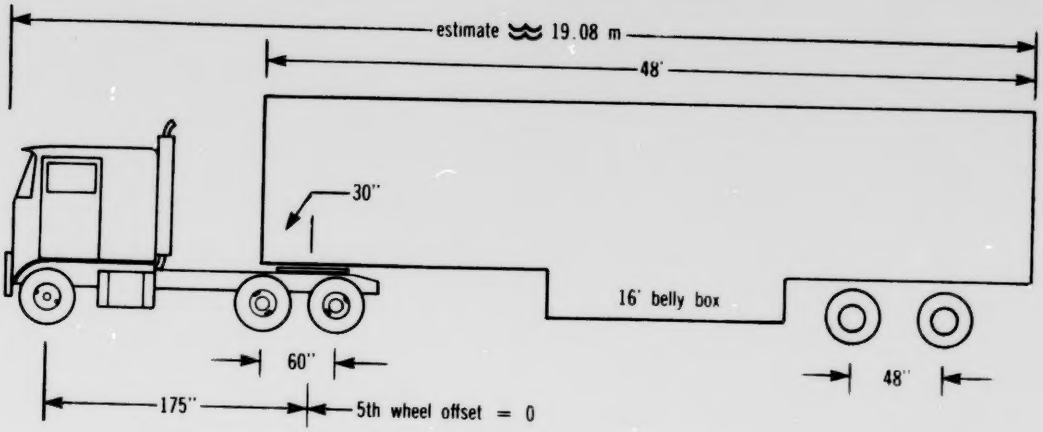
Excluding the equipment used in urban areas or relatively short inter-city hauls (ie, the straight trucks), there are four configurations used by the industry:

i. First, there are the standard 3-S2's with 45' semitrailers. There are two types of semitrailers -- drop frame and "electronic". This second type is referred to as "electronic" as it has a flat floor and originally came into use to haul electronic equipment. Electronic vans are becoming increasingly popular as their flat floor makes loading easier (particularly automobiles). Further, the flat floor does not lose as much cube as it might at first appear. On the underside of these electronic vans, most agents have installed a belly box to carry much of the equipment (loading ramps, car ramps, dollies, etc). These belly boxes can be used to carry some freight (eg, lawn mowers and other "rough stuff"). Depending on the height of the semitrailer (13 to 13.5 ft.) the typical cube of a 45' drop frame is 102.0 to 107.6 m3 (3,600 to 3,800 ft.3) and the typical cube of a flat electronic is 93.5 to 102.0 m3 (3,300 to 3,600 ft.3). (Again, the effective cube of the electronic van is somewhat higher in practice if the belly box is used to carry freight.) The current price of this equipment is about $36,500 (the electronic van being slightly more expensive). The van equipment adds about another $7,000 (plus) to the capital cost of these configurations.

ii. Second, there are 3-S2's with 48' semitrailers. Since the regulatory change in the U.S. (1982) and the corresponding changes in Canadian provinces, 48' semitrailers are now becoming the standard. Again, there are two types -- drop frame and electronic. Typical cubes are 113.3 m3 (4,000 ft.3) for a drop frame (13.5 ft. in height) and 104.8 m3 (3,700 ft.3) for an electronic. The cost of this equipment is only about $350 more than 45' semitrailers (U.S. $78 per foot). (Van equipment costs would be slightly higher also -- ie, more pads, etc.) Specific details on one particular 48' 3-S2 are shown in Figure 4.11.1.

iii. Third, there are 3-S2's with 45' semitrailers and drome boxes. These boxes range in size from 3'-9' in length, and can add from 5.4-16.3 m3 in cube (192 to 576 ft.3 -- these are rough estimates). Note that a 45' semitrailer with a drome can easily have more cube than the new 48' semitrailers. Drome boxes with 48' semitrailers are not being used by the industry -- they are only legal in Quebec and Ontario (assuming they exceed 20 m, or 21 m in two cases) and the industry is constrained by keeping its fleet configured to the lowest common denominator across Canada. Details on a specific 45' van with a 6.5' drome are shown in Figure 4.11.2, and more information on the potential productivity advantages of 48' semitrailers with dromes is shown in Figure 4.11.3.

iv. Fourth, there are 3-S2 container trailers. A rough sketch is shown in Figure 4.11.4. The picture at the bottom of this figure is a city unit owned by Armstrong Moving & Storage Ltd. in Mississauga (note that it does not carry a container on the tractor). The available cube in such a confirmation (the highway unit) is about 4,300 ft.3 (122 m3).


estimate ≈ 19.08 m
48'
30"
16' belly box
60"
48"
175"
5th wheel offset = 0

Moving Systems
UNITED
Van Lines

Figure 4.11.1 United Van Lines: 48' "Electronic" Van

V W D

4.11.2 Fleet - Specific Examples

The length of the 3-S2 shown in Figure 4.11.1 was estimated to be just over 19 m. The cube is probably between 3,600 and 3,700 ft.3 (up to 104.8 m3), and, with an RGVW of 37,000 kg it would have an estimated payload of about 19,989 kg.

In terms of the 45' semitrailer with a drome box shown in Figure 4.11.2, all dimensions shown were measured:

i. Tandem-axle spreads are 1.22 m (48") as the configuration never carries enough weight to justify larger spreads.

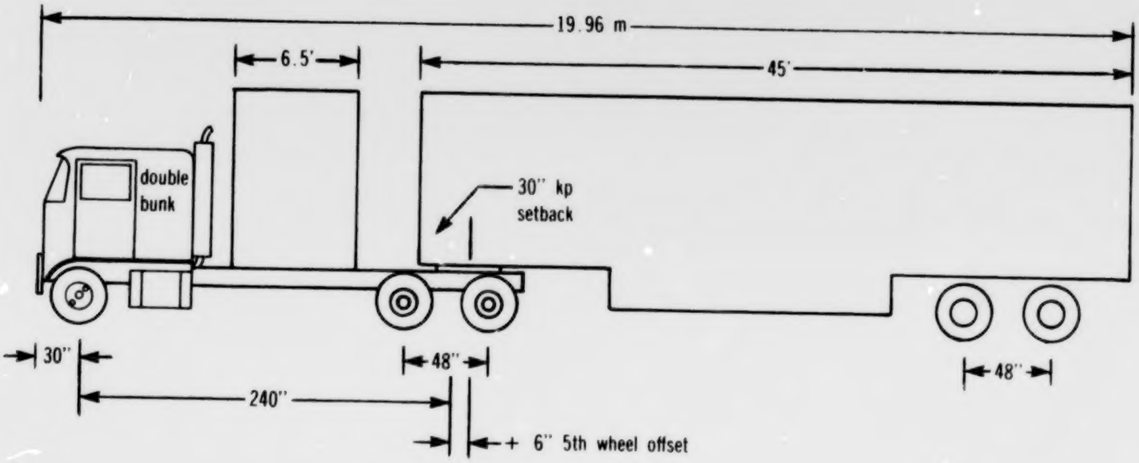
ii. A larger drome box (ie, larger than 6.5') could have been put on the tractor; however, the operator wanted room for his double bunk sleeper.

iii. Total cube (operator was not sure) is estimated at just over 4,000 ft.3 -- possibly 3,600 in the semitrailer and another 400 or so in the drome box.

iv. The tare weight is 18,281 kg (+/- 1%); maximum payload was given as 31,500 lbs. (14,288 kg).

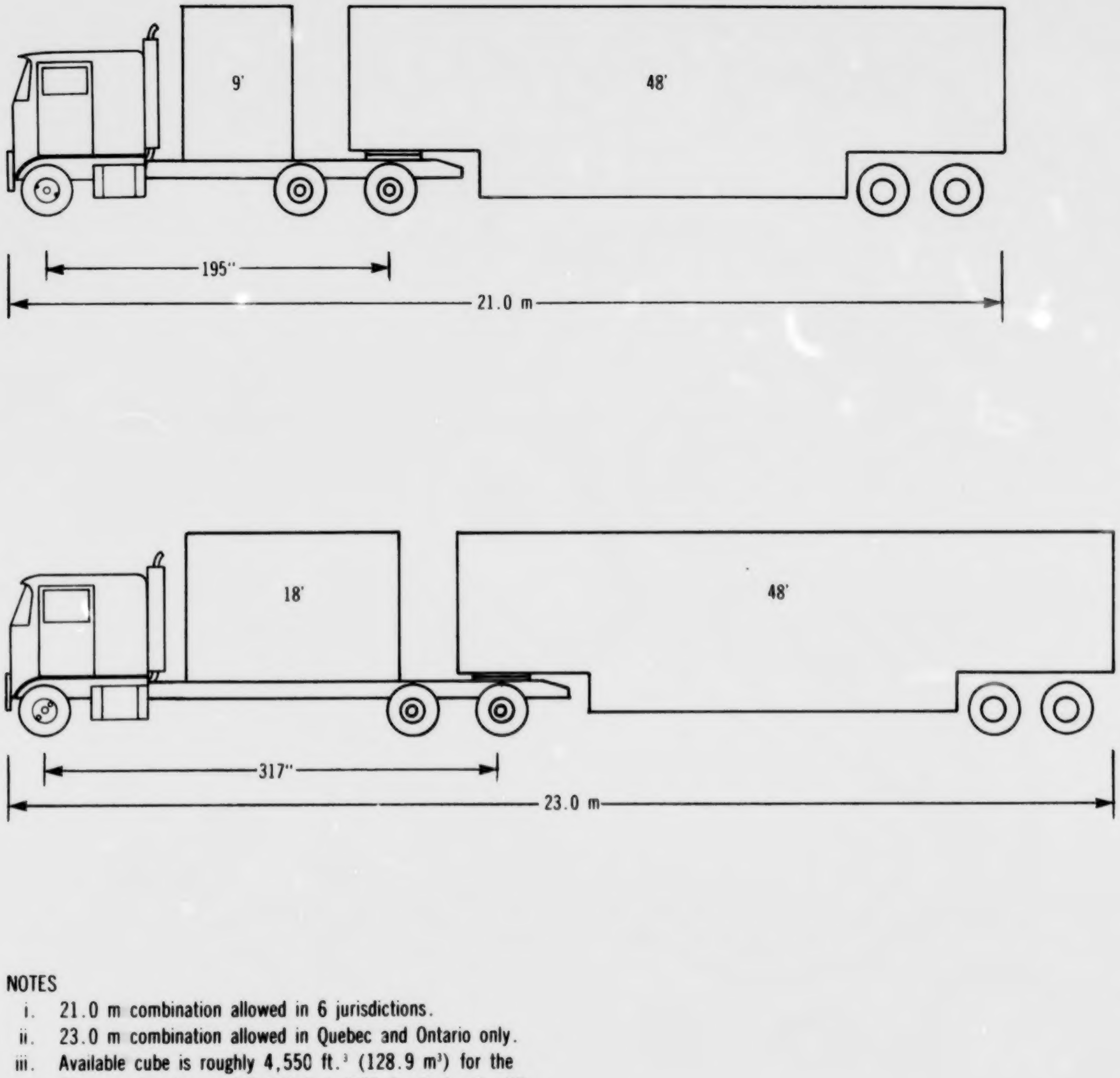
v. The tractor has a 36" slider for the fifth wheel allowing the semitrailer to be moved forewords and backwards. One of the reasons for wanting to move the semitrailer (it is understood) is to control the front axle weight. The operator pointed out that Manitoba was quite rigid in allowing only 11,000 lbs. on the front axle (11" tires) and claimed that the West Hawk scale would not allow higher even if wider tires were used. (The operator claims that Manitoba would not allow 13" tires.)

The configurations shown in Figure 4.11.3 are hypothetical -- they are rough attempts at calculating the effect of permitting 21 m or 23 m tractor-semitrailers to operate across the country. Although some of the measurements are estimated, they are close enough to show that cubes of about 4,600 are possible at 21 m and of over 5,000 at 23 m. Currently, 23 m tractor-semitrailers are only legal in Quebec and Ontario and 21 m are legal in these two provinces plus Nova Scotia, New Brunswick and the two territories. These seemingly very large increases in potential productivity (ie, 12-25% increases in the carrying capacity of household goods vans), have to be interpreted with care. That is, they do not directly translate into linehaul cost savings as larger and larger equipment spends more and more time in urban areas sitting on someone's driveway while it loads. Also, there may be many occasions when the extra cube is simply not used if either there are not enough available shipments or the delay factor means dispatching partially empty vehicles. Having noted this qualification, it is still true that there are some fairly significant productivity advantages available to the industry if all provinces standardized on the current Quebec, Ontario regulations.


19.96 m
6.5'
45'
double bunk
30" kp setback
30"
48"
240"
6" 5th wheel offset
48"

D. Armstrong
Moving Systems
UNITED
UNITED
UNITED
Van Lines

Figure 4.11.2 United Van Lines: 45' Drop Frame with Drome



NOTES

i. 21.0 m combination allowed in 6 jurisdictions.
ii. 23.0 m combination allowed in Quebec and Ontario only.
iii. Available cube is roughly 4,550 ft.^{3} (128.9 m^3) for the 21 m combination and 5,100 ft.^{3} (144.4 m^3) for the 23 m.

Figure 4.11.3 High Cube Household Goods Vans

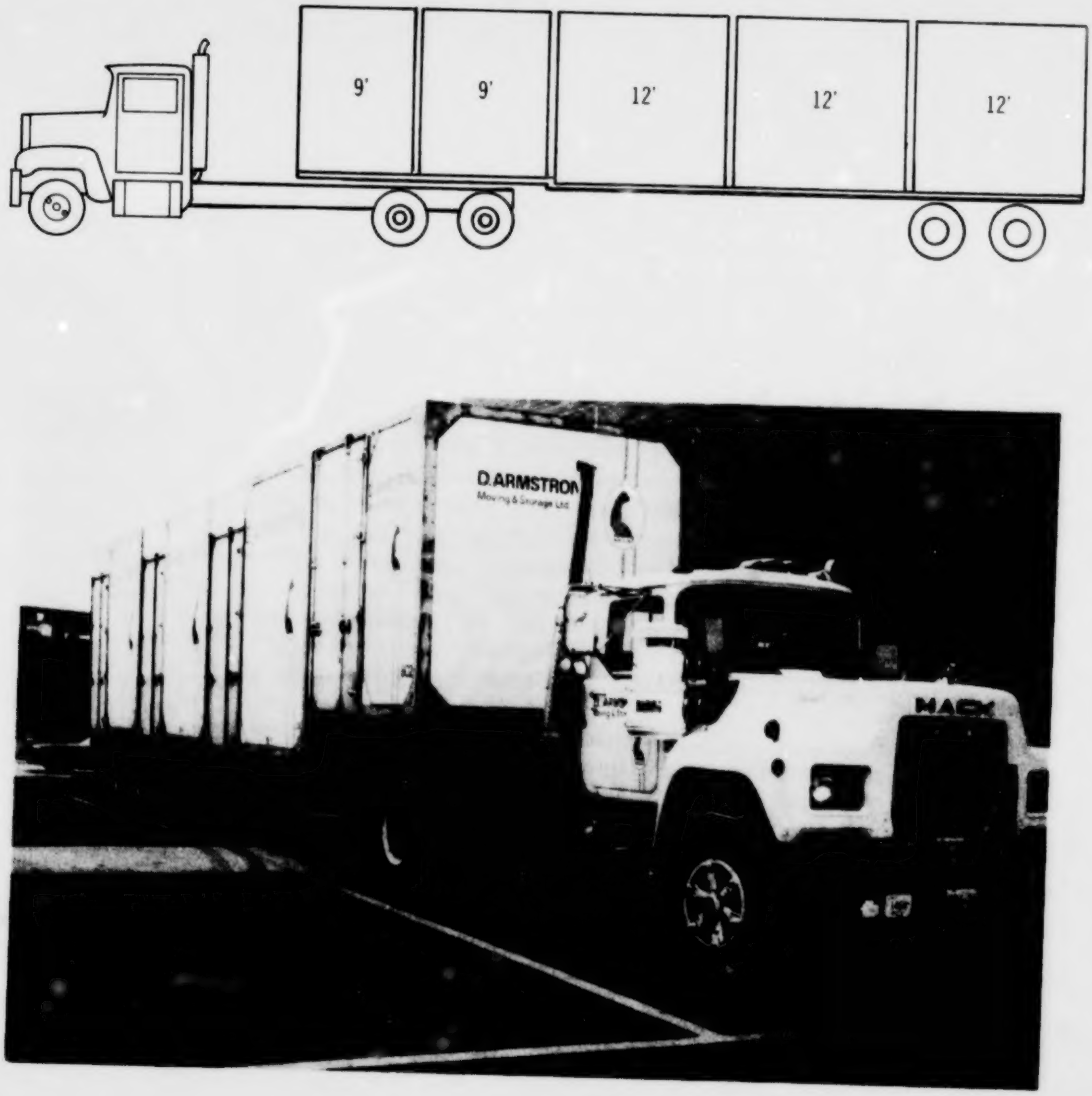

9'
9'
12'
12'
12'
D.ARMSTRON
Moving & Storage Ltd
MACK

Figure 4.11.4 United Van Lines: Container Combination

4.12 REMTECK INC.

Remteck Inc. is a trailer manufacturer located in Chambly. On Figures 4.12.1 and 4.12.2 some of the typical tank trucks used to haul petroleum products in Quebec are shown. Points to note about these configurations are:

i. Front-axle loads are typically in the range of 12,000-14,000 lbs., although there are some tankers where the front-axle is taken as high as 8,500 kg (the legal maximum).

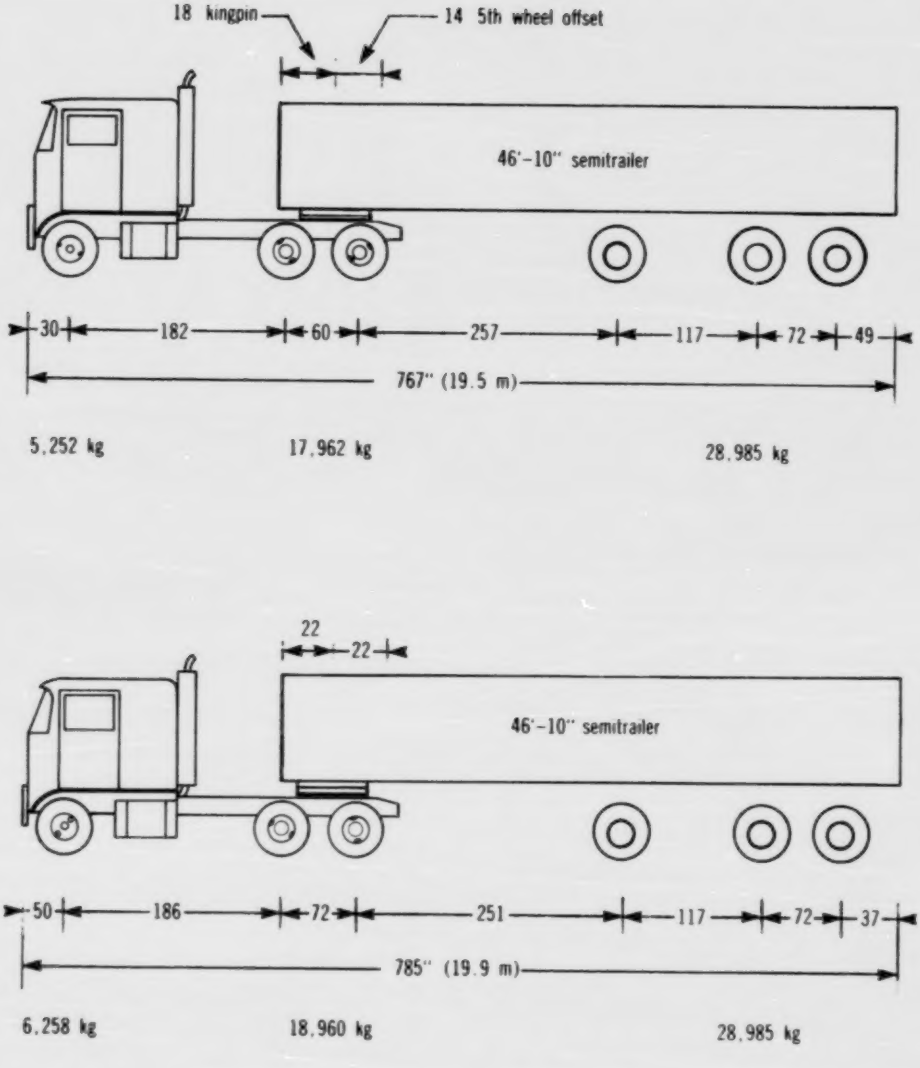
ii. Tandem-drive axles are generally either 60" or 72", with corresponding load limits of 18,000 or 19,000 kg.

iii. The spacing between axles #3-#4 is well above the level where axle-spacing penalties would apply to the allowed GVW. While there is no single distance for these axle-spacing penalties (it depends on the particular combination of axles) the closest relevant one is 4.8 m. The tankers shown on Figures 4.12.1 and 4.12.2 have spacings over 6 m

iv. The choices with respect to the three axles on the semitrailer appear to be as follows: (a) the 95"-95" axle is a "triple" axle under Quebec's regulations (equal spacing, load-equalizing ability) and therefore is allowed a slightly higher loading than the equivalent tri-axle (single plus tandem) alternative; (b) in the cases shown, three axles with an outer spacing of 4.8 m (or the 189"-190" shown in the four configurations) are allowed a load of 30,000 kg if they are a triple axle and 29,000 kg if they are a tri-axle; (c) counteracting this (slight) axle-load advantage that the triple has over the tri-axle, the 95"-95" configuration is harder on tires; (d) it is understood that the triple axle (95"-95") is generally chosen where the vehicle is to be used mainly on highways and the tri-axle (117"-72") is chosen where the vehicle is to be used more on local roads.

v. It is interesting to note that the choices with respect to the three axles on the semitrailer can also be influenced by the position of the fifth wheel offset and kingpins. That is, as shown in the bottom of Figure 4.12.1, a tanker with the 117"-72" tri-axle can easily register at GVW's as high as the triple-axle alternatives shown on Figure 4.12.2 -- the key being the 22" offset for the fifth wheel and the 22" kingpin setback, with the resulting 6,258 kg front-axle load. While it is not known how far the industry can feasibly increase the GVW of a 3-S3, on paper it can be shown that they can be registered at the legal maximum of 57,500 kg.

In terms of the use of trains in Quebec, this manufacturer knew of only one company that was using this configuration. The reason is that there is no payload advantage to using trains in Quebec, unlike the situation in other provinces (ie, a tractor-semitrailer can be registered at the highest GVW).

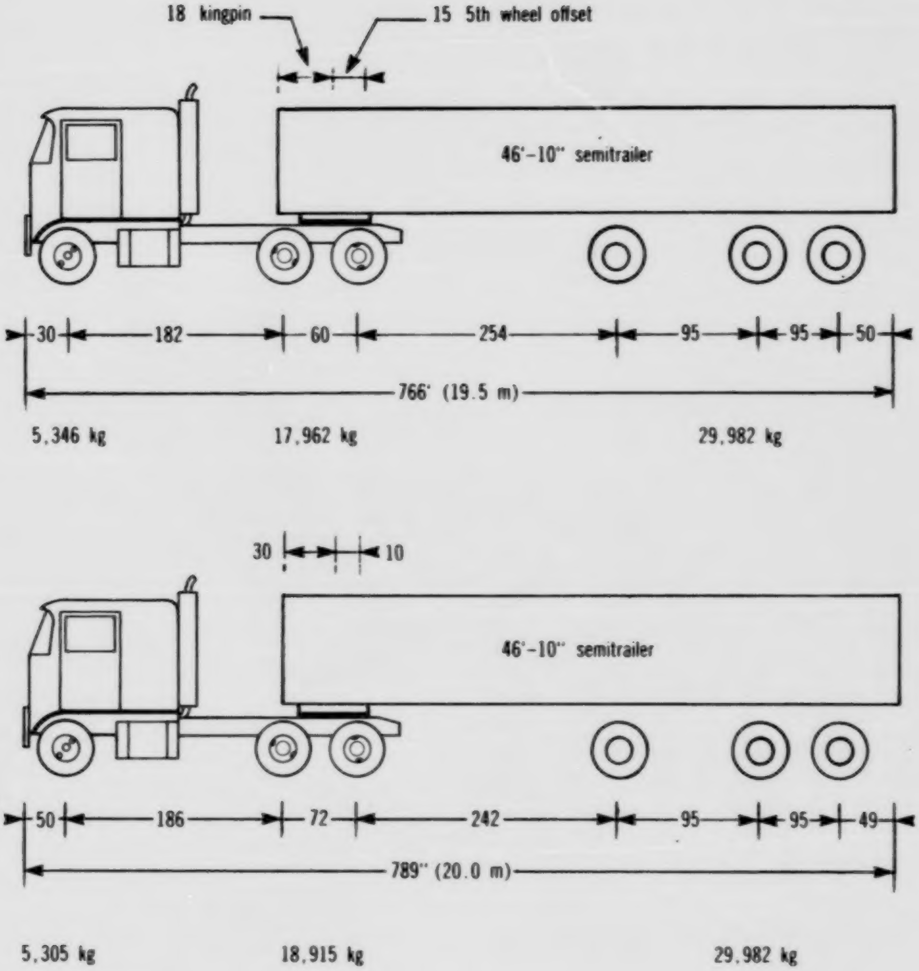

18 kingpin
14 5th wheel offset
46'-10" semitrailer
30
182
60
257
117
72
49
767" (19.5 m)
5,252 kg
17,962 kg
28,985 kg
22
22
46'-10" semitrailer
50
186
72
251
117
72
37
785" (19.9 m)
6,258 kg
18,960 kg
28,985 kg

NOTES

i. Dimensions shown in inches, axle loads in kilograms.

		Top	Bottom
ii.	Tare Weight (kg)	17,237	17,055
iii.	Capacity (L)	50,000	51,000
iv.	Payload (L)	48,000	51,000
	(kg)	34,962	37,147
v.	GVW (kg)	52,199	54,202

Figure 4.12.1 Remtec Inc.: Quebec Tankers (1)


18 kingpin
15 5th wheel offset
46'-10" semitrailer
30
182
60
254
95
95
50
766" (19.5 m)
5,346 kg
17,962 kg
29,982 kg
30
10
46'-10" semitrailer
50
186
72
242
95
95
49
789" (20.0 m)
5,305 kg
18,915 kg
29,982 kg

NOTES

i. Dimensions shown in inches, axle loads in kilograms.

		Top	Bottom
ii.	Tare Weight (kg)	17,237	17,055
iii.	Capacity (L)	50,000	51,000
iv.	Payload (L)	49,500	51,000
	(kg)	36,055	37,147
v.	GVW (kg)	53,292	54,202

Figure 4.12.2 Remtec Inc.: Quebec Tankers (2)

4.13 ONTARIO WEIGH SCALE

Several configurations from central Canada not previously described were seen at the Trafalgar Road weigh scale (Highway 401 west of Toronto).

In Figure 4.13.1 two 8-axle A-trains are shown -- a tank truck and a container carrier. The commodity being hauled in the tank is not known (presumably it is not very dense). Unlike the 8-axle A-trains used by the gravel haulers, these use 3-axle pups. (The 8-axle A-trains used by the gravel industry tended to be 3-S3-2 configurations.)

The 9-axle B-train in Figure 4.13.2 has been included as this is a relatively rare type of B-train -- a 3-S4-S2. Note the quad-axle on the lead semitrailer and the very wide tandem spread on the rear semitrailer. Also included in Figure 4.13.2 is another relatively uncommon configuration -- a 3-axle truck with a 5-axle trailer used to haul scrap metal. Presumably this configuration has been selected because of the mechanism used to load the bins (*the details of how this is done are not known*.)

axle #	**1**	**2-3**	**4**	**5**	**6-7-8-9**
spreads		1.6			3.71
spacings	4.54	3.57	2.78	2.81	
loads					
- actual	4,570	20,970	7,990	7,780	24,430
- legal		18,300	10,000	10,000	24,200

The 9-axle tractor-semitrailers, 3-S6's, shown in Figure 4.13.3 are unique to Ontario. The point to note is that these configurations can be registered at the highest GVW in Ontario (in the western provinces, doubles have to be used to register at the highest GVW). The second 3-S6 shown (a dry bulk tank hauling limestone dust) is an interesting case study. Although it has plenty of axles, its legal GVW is only 60,600 kg (it was caught at the scales with 65,740 kg and over-loaded on the drive tandems and the rear-most 4-axle group). The following shows the axle spreads, spacings, actual and legal loads:

From a design standpoint, this 3-S6 would be more efficient if two of the rear-most axles were cut off, if axle #4 were extended slightly (to increase the inter-vehicle-unit-distance to 3.6 m), and if the load on the front axle was increased. With seven axles instead of the nine it now has it could both register at a higher GVW and shed a couple of thousand kilograms of useless tare weight.

Finally, in figure 4.13.4, two 8-axle B-trains used to haul steel are shown. Note the raised position of the fourth axle in the top photograph -- a likely indication that this unit operates into Western Canada.

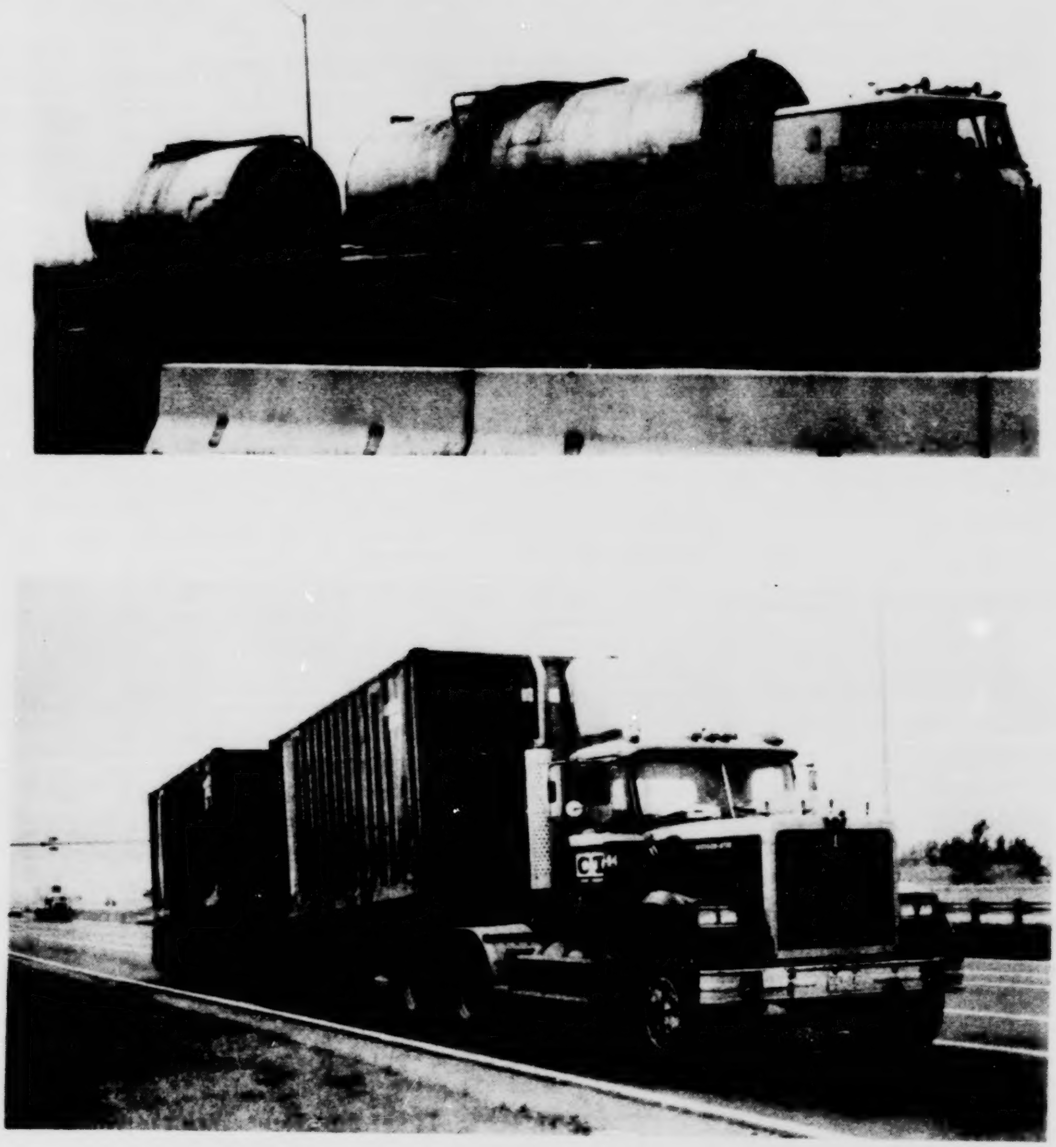


Figure 4.13.1 Ontario: 3-S2-3

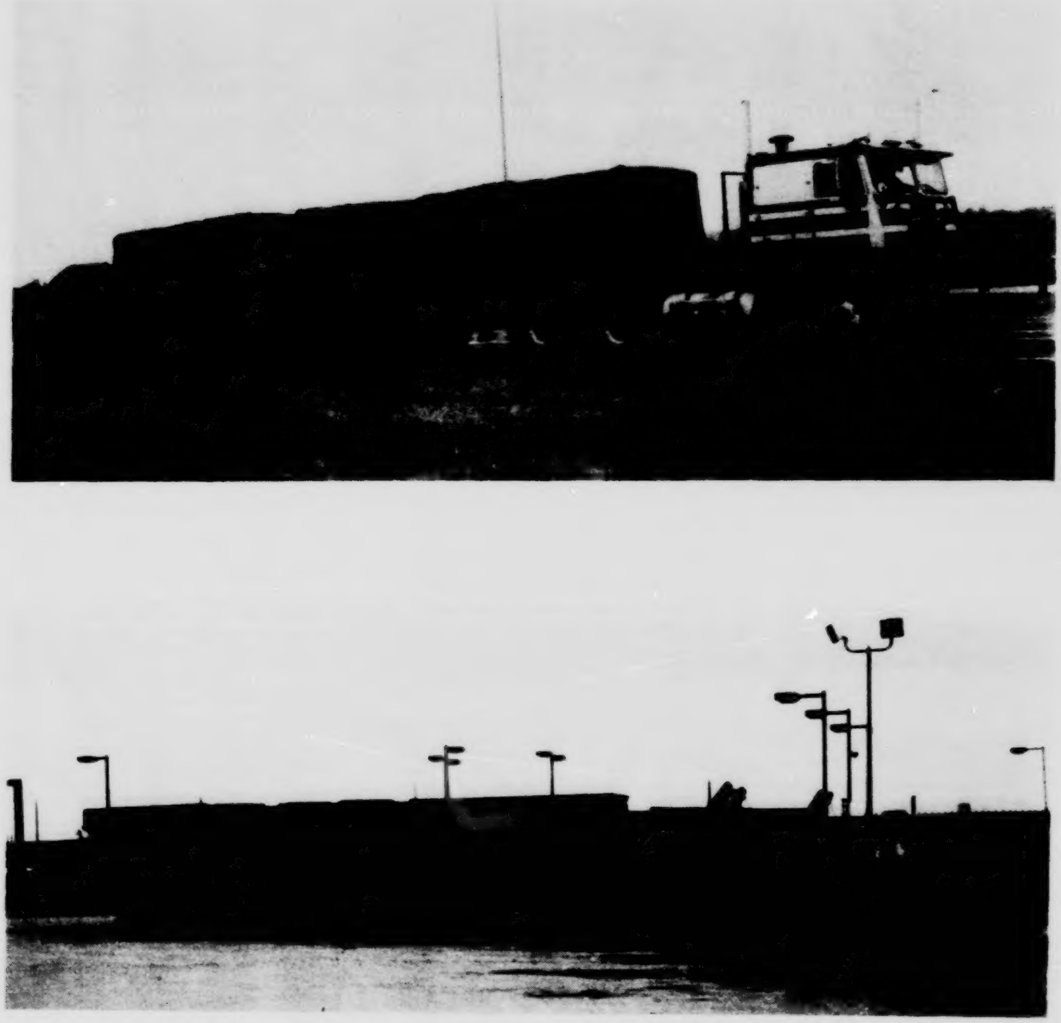


Figure 4.13.2 Ontario: 3-S4-S2 & 3-5

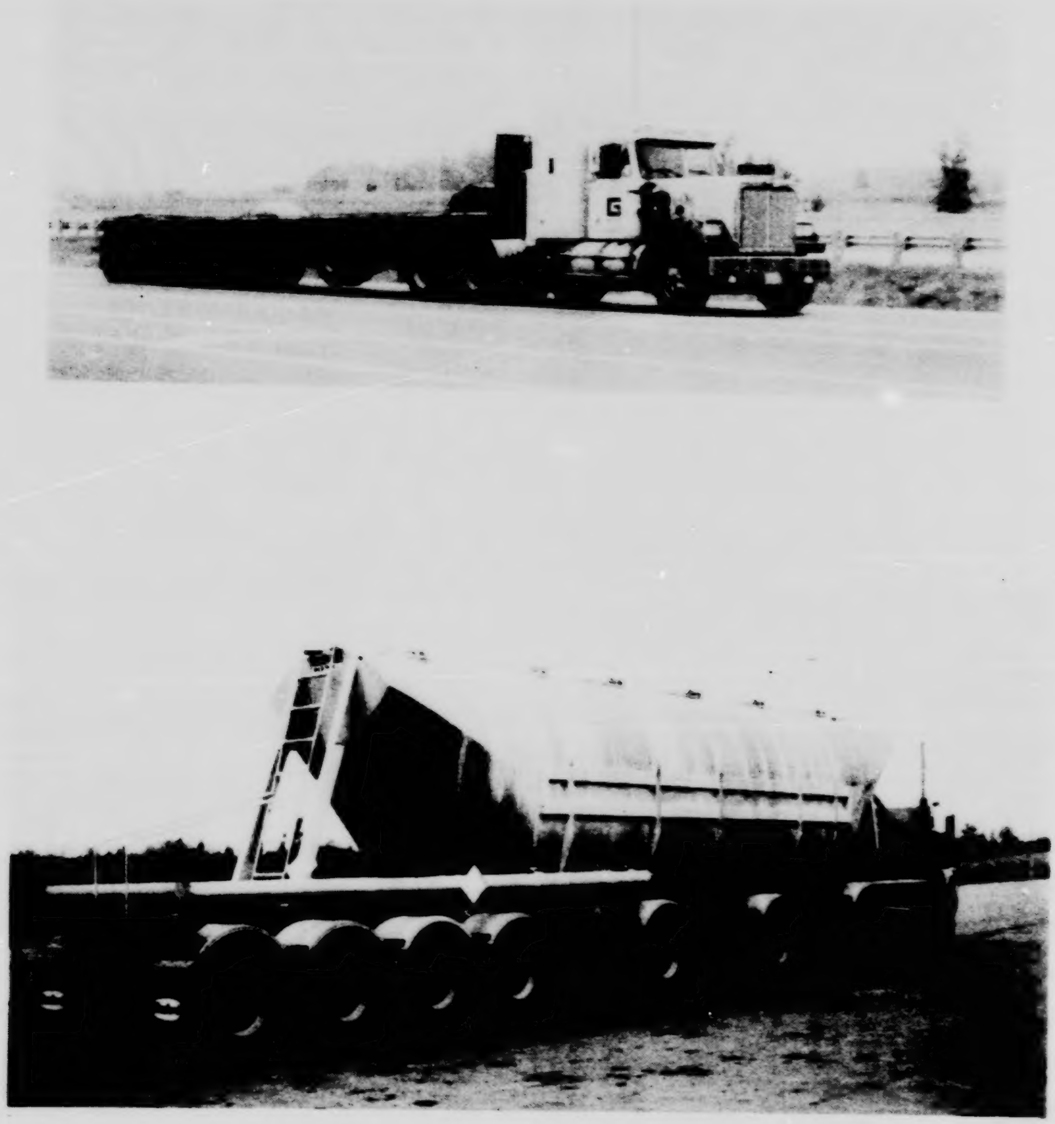


Figure 4.13.3 Ontario: 3-S6

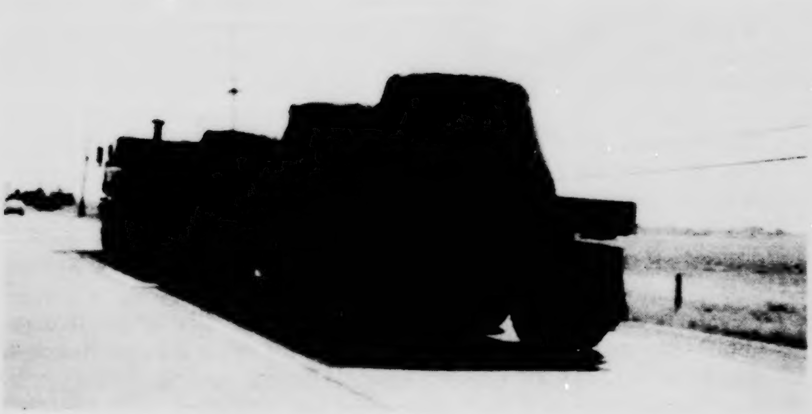


Figure 4.13.4 Ontario Steel Haulers: 3-S3-S2

5. Case Studies: Manitoba

5.1 KLEYSEN TRANSPORT LTD.

Kleysen is an irregular route, truckload commodity carrier, with its head office in Winnipeg and terminals in British Columbia, Alberta, Saskatchewan, Manitoba, Toronto, and Chicago. The company's trailer equipment is illustrated in Figures 5.1.1 to 5.1.6. There are three basic configurations: standard 5-axle tractor semitrailers (3-S2); standard 7-and 8-axle A-trains (3-S2-2, and 3-S2-3); and, standard 7-axle B-trains (3-S2-S2).

Fleet configuration characteristics directly attributable to weight and dimension regulatory provisions are:

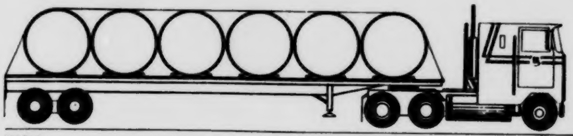
i. Most of the pup trailers for the A-train units are equipped with adjustable tongues. The basic tongues are designed to provide 3.5 m spacing between the dolly axle and the rear- most axle on the semitrailer's tandem axle: this is the spac- ing required to permit full loading of these axles for opera- tion in the Prairie provinces. By shortening the tongues, and using short wheelbase tractors, the same units could be reduced to an overall vehicle length which fit into the pre- 1982 Ontario length limit of 21.0 m. While this is no longer an issue, it is still reflected in the fleet characteristics. By lengthening the tongues, the A-trains can be stretched to permit higher GVW's in the U.S. than would otherwise be permitted, pursuant to Bridge Formula B. Thus, for example, by stretching the units to 80' plus, Kleysen can operate a 7- axle A-train in Idaho at a GVW of (about) 105 kips.

ii. Maximum total trailer length in Kleysen's double train sets is (about) 54 ft. (eg, 26' + 28' for B-train flats). This results from the 16.75 m kingpin-to-rear limit prevailing in most Canadian jurisdictions. This restriction makes it difficult to adopt the U.S. double-trailer standard of two 28' pups (or equivalent combinations offering 56' of trailer) into the Kleysen fleet.

iii. Kleysen prefers A-trains over B-trains for any situation which involves, or might involve, U.S. operation. The reason for this is that the standard 7-axle B-trains (26' + 28' trailers) typically have a spacing of 62-63 ft. from the front steering axle to the rear-most axle of the unit, and a corresponding GVW limit of about 96 kips pursuant to Bridge Formula B. Given a tare weight of 40-42 kips for such units, maximum payloads in the U.S. are 54-56 kips using B-trains (more or less the same load that can be handled on a low tare weight 3-S2) versus about 65 kips on stretched A-trains.

Other regulatory-related considerations which have influenced Kleysen fleet characteristics are:

FLAT DECK EQUIPMENT

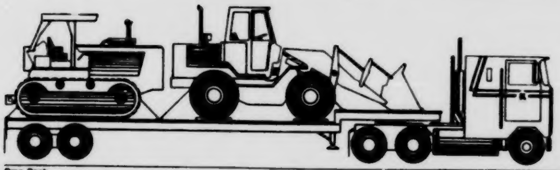


Flat Deck

General commodities, farm, construction and industrial machinery, building materials, including lumber, plywood, plasterboard, steel sheeting, coils, beams, pipe and all palletized and bagged commodities

Special Features:

Interchangeable sides: 2, 3 and 4 sliding tandem axles, complete tarping protection available

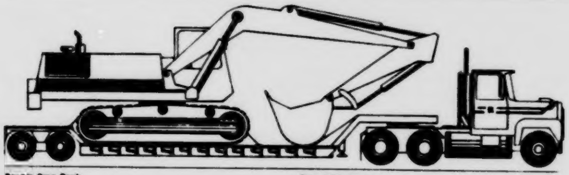


Drop Deck

Capable of transporting the same commodities as flat decks, and other non-reducible loads which are higher than normal, including tractors, farm, construction and industrial machinery

Special Features:

Trailer is lower to ground, enabling higher commodities to be loaded. Interchangeable sides: 2, 3 and 4. Complete tarping protection available

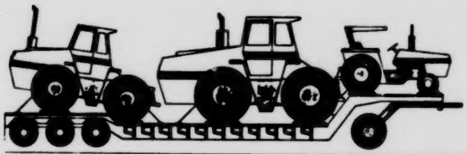


Double Drop Deck

Large over-dimensional loads, including farm, construction and industrial machinery, combines, transformers, and other non-reducible loads. Can haul all the same commodities as a flat deck or drop deck

Special Features:

Trailer is lower to ground than drop deck, enabling higher commodities to be loaded. Outriggers for extra width and safety, recessed wheel wells to reduce height of machines, heavy duty tie-down rings to secure loads.

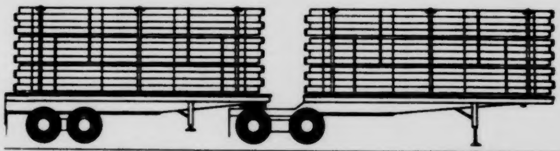


Double Drop Low Bed

48' deck space enables the unit to transport all the commodities that a double drop deck can, and more. Attachable 3rd axle on rear of trailer and additional single axle payloader jeep enable the unit to transport very heavy non-reducible loads that require additional axles for transportation

Special Features:

Trailer can be operated with or without 3rd axle on rear of trailer or the single axle payloader depending on application. Additional deck space and weight capability, air ride suspension, outriggers for extra width and safety, heavy duty tie-down rings to secure loads

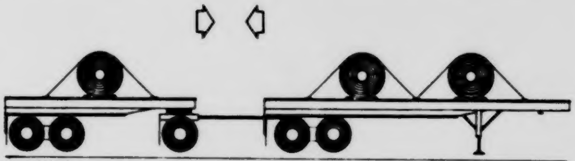


B-Train Flat Deck

General commodities, farm, construction and industrial machinery, building materials, including lumber, plywood, plasterboard, steel sheeting, coils, beams, pipe and all palletized and bagged commodities. Ideally suited for loads that require more deck space than a flat deck or require additional weight carrying capacity

Special Features:

Interchangeable sides: 2, 3 and sliding tandem axles on rear trailer, complete tarping protection available



A-Train Flat Deck

This "A-Train" configuration complete with an extra single axle converter enables even greater weight carrying capacity than a B-Train. All commodities that can be hauled on a "B-Train" can be hauled on an "A-Train".

Special Features:

Interchangeable sides: 2, 3 and 4. Complete tarping protection available. Adjustable length tongue between trailers for maximum weight carrying capacity in various State and Provincial jurisdictions

Figure 5.1.1 Kleysen Transport: Configurations (1)

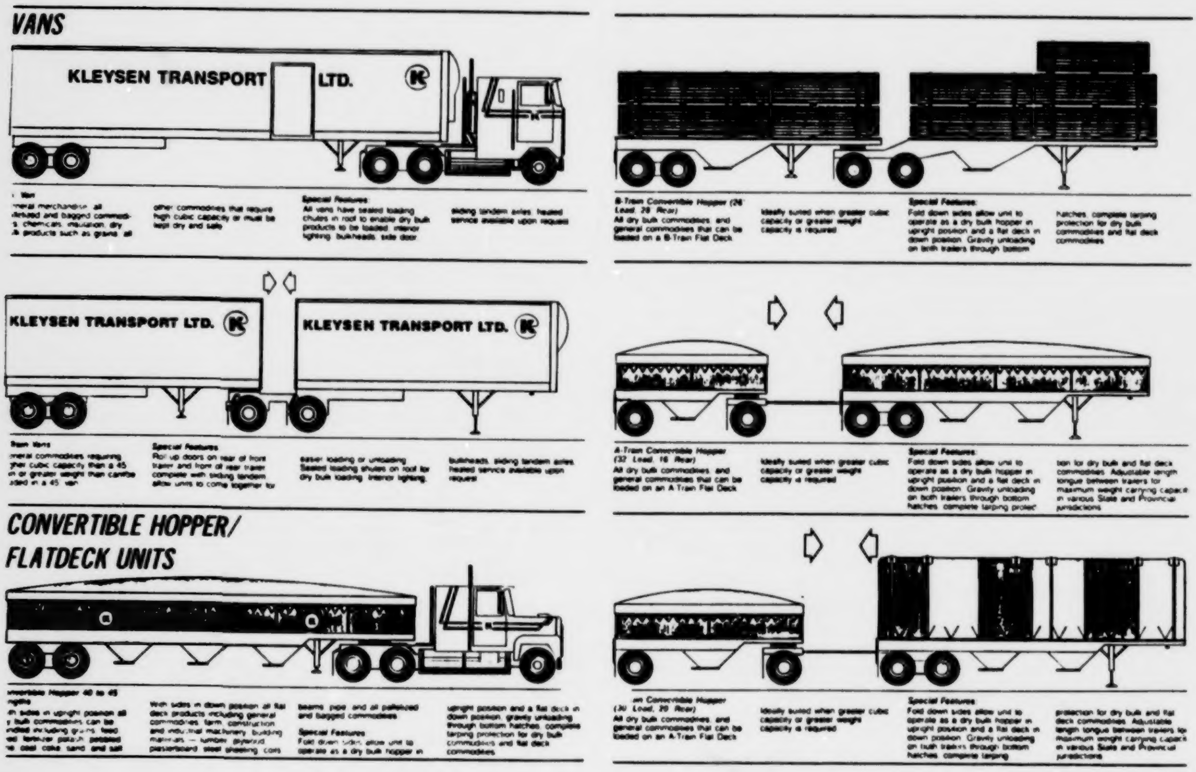

VANS
KLEYSEN TRANSPORT LTD.
KLEYSEN TRANSPORT LTD.
KLEYSEN TRANSPORT LTD.
CONVERTIBLE HOPPER/
FLATDECK UNITS

Figure 5.1.2 Kleysen Transport: Configurations (2)

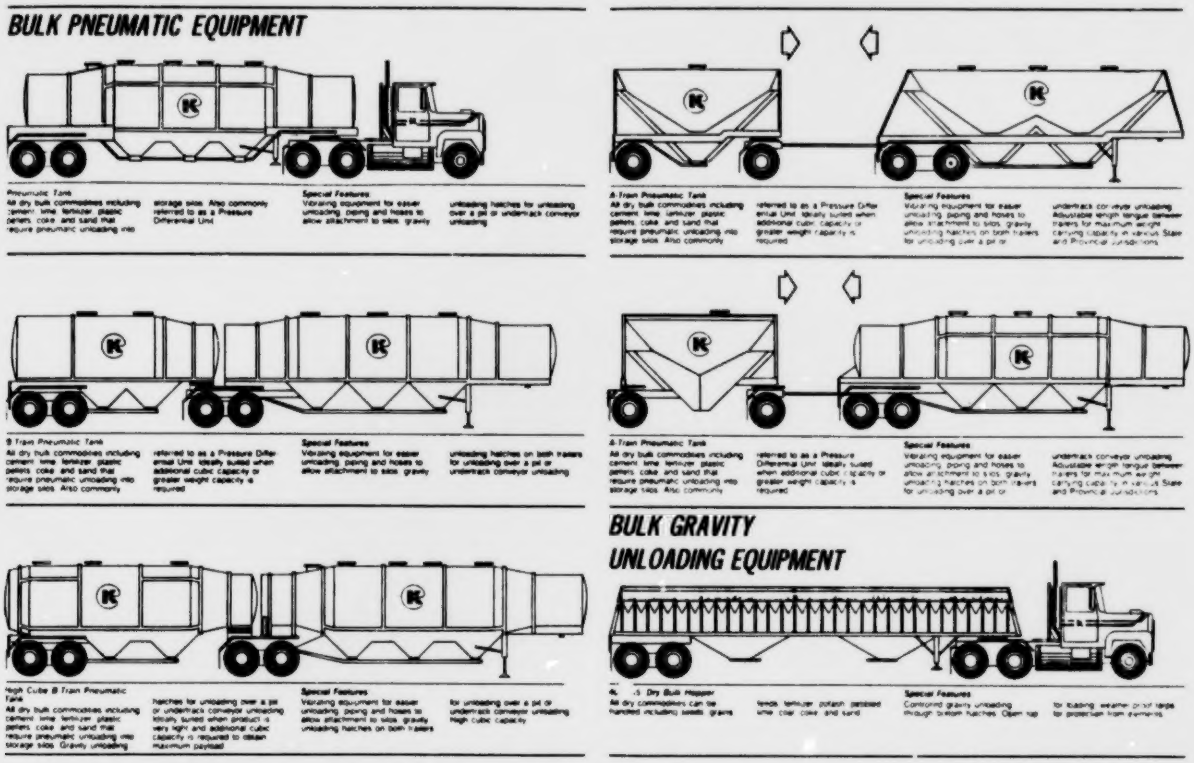
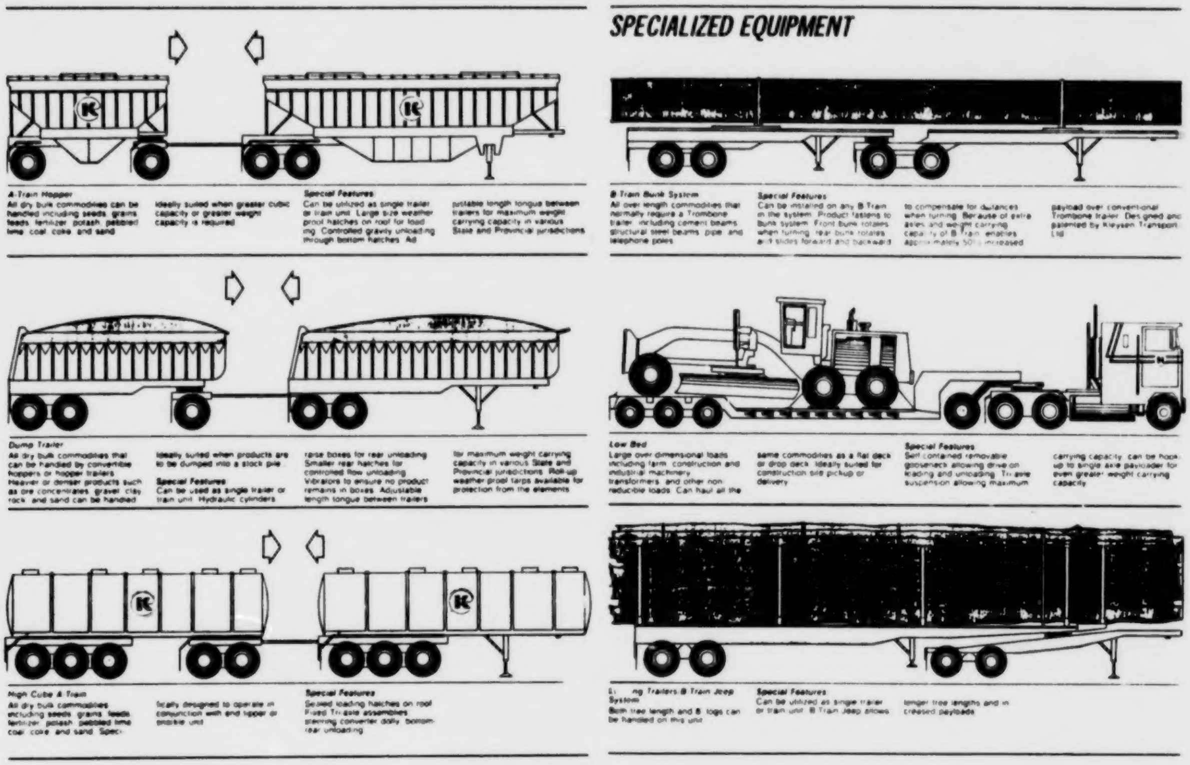

BULK PNEUMATIC EQUIPMENT
Pneumatic Tank
Special Features
A-Train Pneumatic Tank
Special Features
B Train Pneumatic Tank
Special Features
A-Train Pneumatic Tank
Special Features
High Cube B Train Pneumatic Tank
Special Features
BULK GRAVITY UNLOADING EQUIPMENT
Dry Bulk Hopper
Special Features

Figure 5.1.3 Kleysen Transport: Configurations (3)



SPECIALIZED EQUIPMENT

A-Train Hopper
All dry bulk commodities can be handled including seeds, grains, feeds, fertilizer, potash, pebbled lime, coal, coke, and sand. Ideally suited when greater cubic capacity or greater weight capacity is required.

Special Features
Can be utilized as single trailer or train unit. Large size weather proof hatches on roof for loading. Controlled gravity unloading through bottom hatches. Adjustable length tongue between trailers for maximum weight carrying capacity in various State and Provincial jurisdictions.

Dump Trailer
All dry bulk commodities that can be handled by convertible hoppers or hopper trailers. Heavier or denser products such as ore concentrates, gravel, clay, rock, and sand can be handled. Ideally suited when products are to be dumped into a stock pile.

Special Features
Can be used as single trailer or train unit. Hydraulic cylinders raise boxes for rear unloading. Smaller rear hatches for controlled flow unloading. Vibrators to ensure no product remains in boxes. Adjustable length tongue between trailers for maximum weight carrying capacity in various State and Provincial jurisdictions. Roll-up weather proof tarps available for protection from the elements.

High Cube A-Train
All dry bulk commodities including seeds, grains, feeds, fertilizer, potash, pebbled lime, coal, coke, and sand. Specifically designed to operate in conjunction with end tipper or mobile unit.

Special Features
Sealed loading hatches on roof. Fixed Tri-axle assemblies, steering converter dolly, bottom-rear unloading.

B Train Bunk System
All over length commodities that normally require a Trombone trailer, including cement beams, structural steel beams, pipe and telephone poles.

Special Features
Can be installed on any B-Train in the system. Product fastens to bunk system. Front bunk rotates when turning, rear bunk rotates and slides forward and backward to compensate for distances when turning. Because of extra axles and weight carrying capacity of B-Train, enables approximately 50% increased payload over conventional Trombone trailer. Designed and patented by Kleysen Transport Ltd.

Low Bed
Large over dimensional loads including farm, construction and industrial machinery, transformers, and other non-reducible loads. Can haul all the same commodities as a flat deck or drop deck. Ideally suited for construction site pickup or delivery.

Special Features
Self contained removable gooseneck allowing drive-on loading and unloading. Tri-axle suspension allowing maximum carrying capacity. Can be hooked up to single axle payloader for even greater weight carrying capacity.

Logging Trailers/B Train Jeep System
Both tree length and 8' logs can be handled on this unit.

Special Features
Can be utilized as single trailer or train unit. B Train Jeep allows longer tree lengths and increased payloads.

Figure 5.1.4 Kleysen Transport: Configurations (4)

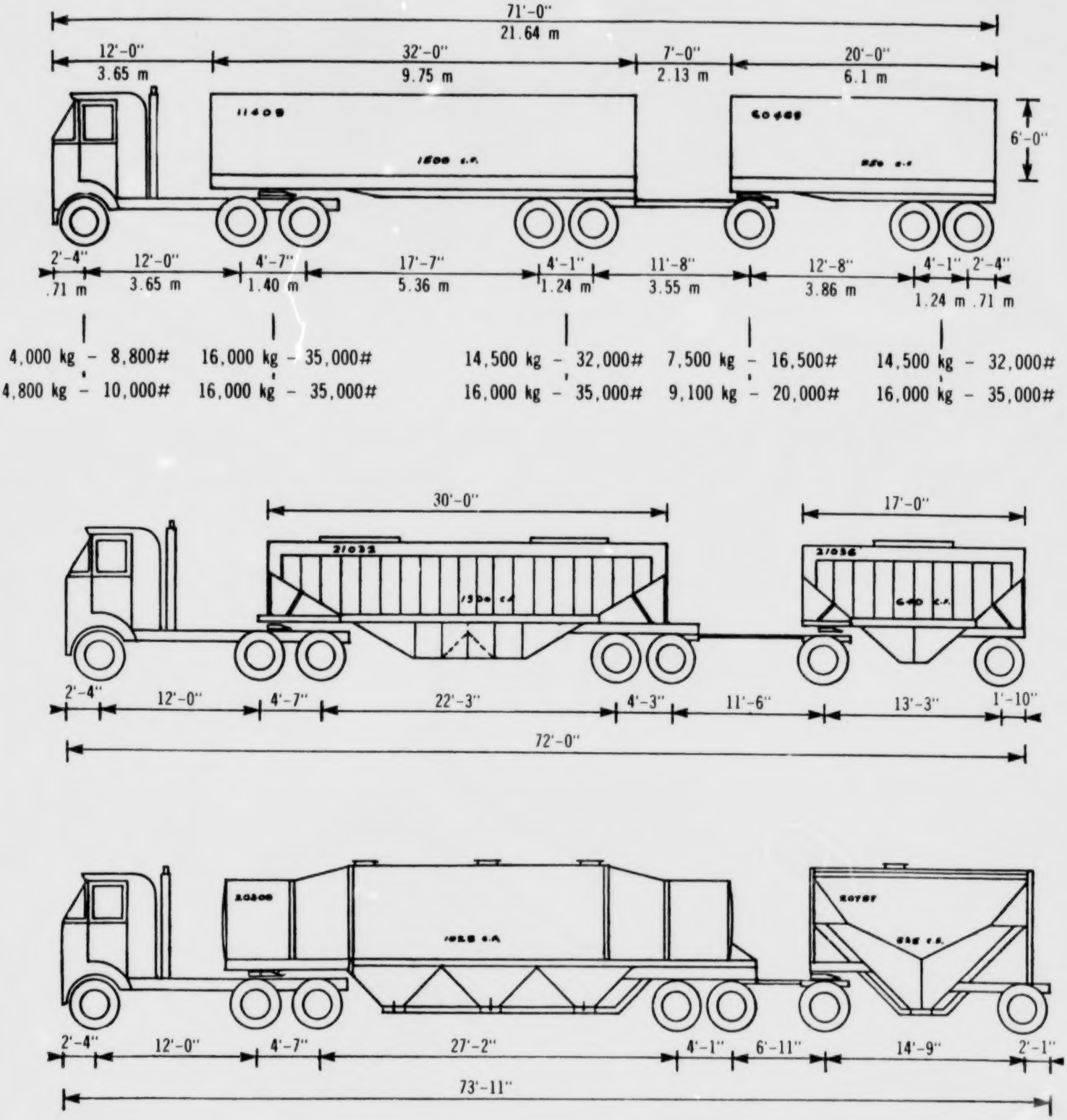
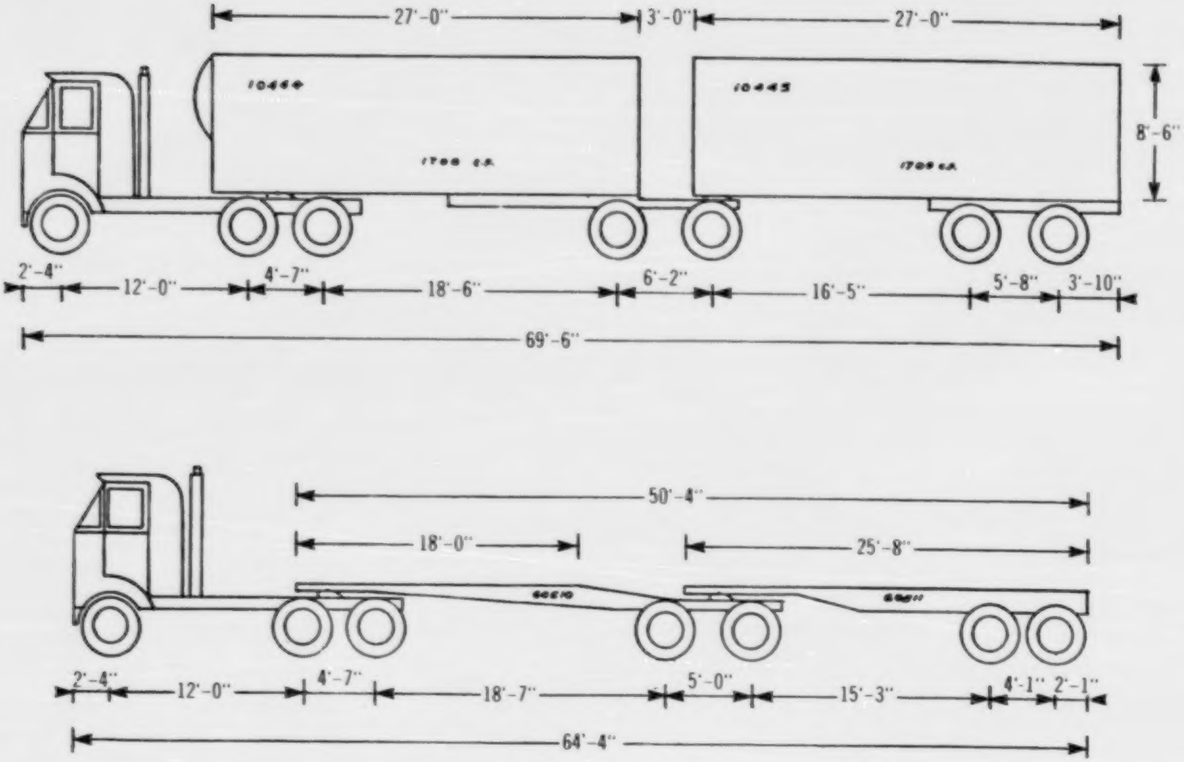

71'-0"
21.64 m
12'-0"
3.65 m
32'-0"
9.75 m
7'-0"
2.13 m
20'-0"
6.1 m
11409
6'-0"
2'-4"
.71 m
12'-0"
3.65 m
4'-7"
1.40 m
17'-7"
5.36 m
4'-1"
1.24 m
11'-8"
3.55 m
12'-8"
3.86 m
4'-1"
2'-4"
1.24 m
.71 m
4,000 kg - 8,800#
4,800 kg - 10,000#
16,000 kg - 35,000#
16,000 kg - 35,000#
14,500 kg - 32,000#
16,000 kg - 35,000#
7,500 kg - 16,500#
9,100 kg - 20,000#
14,500 kg - 32,000#
16,000 kg - 35,000#
30'-0"
17'-0"
21032
21036
2'-4"
12'-0"
4'-7"
22'-3"
4'-3"
11'-6"
13'-3"
1'-10"
72'-0"
2'-4"
12'-0"
4'-7"
27'-2"
4'-1"
6'-11"
14'-9"
2'-1"
73'-11"

Figure 5.1.5 Kleysen Transport: A-trains


27'-0"
3'-0"
27'-0"
10444
1700 c.f.
10445
1700 c.f.
8'-6"
2'-4"
12'-0"
4'-7"
18'-6"
6'-2"
16'-5"
5'-8"
3'-10"
69'-6"
50'-4"
18'-0"
25'-8"
2'-4"
12'-0"
4'-7"
18'-7"
5'-0"
15'-3"
4'-1"
2'-1"
64'-4"

42' FRAME ONLY — NO DECK

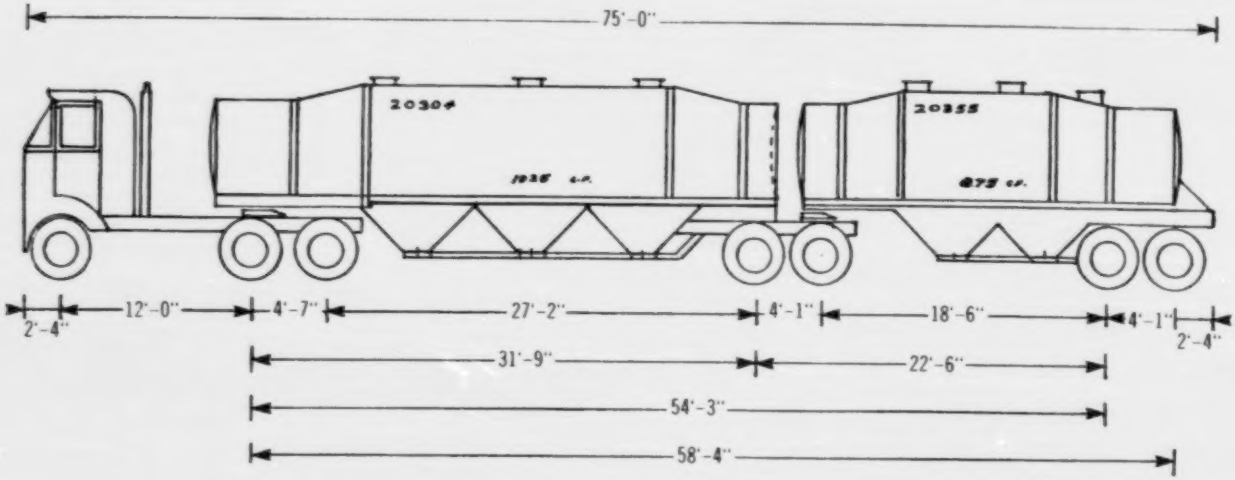

75'-0"
20304
1935 c.f.
20355
875 c.f.
2'-4"
12'-0"
4'-7"
27'-2"
4'-1"
18'-6"
4'-1"
2'-4"
31'-9"
22'-6"
54'-3"
58'-4"

Figure 5.1.6 Kleysen Transport: B-trains

i. Kleysen used to employ 72 inch tandem spreads in Ontario to gain the related weight advantage; however the company experienced too much plowing and difficulty with steering with these spreads, and has reverted to a 60 inch standard.

ii. Forty-eight foot trailers are rapidly being adopted as the industry norm, largely because of pressure from shippers. U.S. shippers often order 48' trailers not because they want or need the extra length, but because they know they are wide (102") trailers.

Other observations made by the carrier of interest to various regulatory considerations are:

i. Kleysen has some concern about the stability of pup trailers of less than 20 ft. in length, believing that some loads such as lumber are subject to too much movement because of the bouncing of short pups.

ii. One of the factors which contributed to the emergence of some of Ontario's unique fleet characteristics was a lack of enforcement of the axle weight limits in Ontario in the early days after adoption of the Ontario Bridge Formula; the vehicles were being checked primarily for GVW compliance, not axle weight compliance as a function of spacing.

iii. The price of double-trailer sets is essentially double that of a single trailer. For weigh-out operations, this discourages the adoption of doubles in a jurisdiction like Ontario, where a single can be configured to provide the same weight payload capacity as a double. For cube-out operations, this substantially higher cost may not be recoverable from the relatively limited cubic advantage of a double (54' of trailer) versus a large single (48').

Kleysen moves specialty lumber products from Idaho to southern Ontario, often returning with steel destined for Western Canada. Bridge Formula B applied to a GVW limit of 105 kips governs the operation in the U.S. Under that Formula, a standard Canadian flatbed B-train (26' lead, 28' pup) is limited to 96 kips GVW; with 42 kips tare, the maximum payload which a B-train could handle is therefore 54 kips, or a little more than could be handled by a low tare weight, 5-axle, 3-S2 unit.

To make the operation viable, the carrier must employ an A-train configuration, using an extendable tongue, on the U.S. leg of the trip. Pursuant to Bridge Formula B, stretching a 3-S2-2 A-train to provide a spacing of 77' between the steering axle and the rear-most axle on the unit (giving a total length of 80' plus) permits operation of the unit at 105 kips, handling a payload of 63 kips (given a tare of 42 kips). The unit is brought into Canada on the Alberta border, where it is shortened to comply with Alberta's 23 m length limit, and then taken to Calgary. The lumber is off-loaded, and re-loaded on to a 7-axle B-train for movement to southern Ontario. The A-trains stay to operate on the "tongued" traffic lane (ie, between Alberta and the northwest U.S.).

The B-train can handle a payload of 76 kips (118 kips GVW in Alberta and Saskatchewan, minus 42 kips tare), but has direct access to only 63 kip loads brought from the U.S. by the A-trains. The carrier accordingly tries to group loads to make full use of the Canadian payload capacity (ie, make five loads in Calgary out of six from the U.S.), although in doing so may have to mix up shipments or otherwise alter the loads envisaged by the shipper/consignee. An alternative approach (feasible only as the market will bear) is to rate the shipment at a 70 - kip minimum; this approach tries to pass on the problem of conflicting weight restrictions to the shipper/consignee.

The B-trains are taken into southern Ontario, and are loaded with steel for the return trip at a 118 kip level (ie, the Prairie provinces' maximum GVW on a B-train). Kleysen indicated that one of the consider- ations affecting vehicle selection and payloads for the movement of steel from southern Ontario to Western Canada is that the product can be dis- patched without it destination being known. Thus, for example, the carrier must be prepared to move the load into Manitoba or Saskatchewan, or beyond; accordingly, the carrier loads only to the level and in the manner permitted in the most restrictive jurisdiction in which the carrier believes the vehicle may have to travel.

Other information developed with Kleysen is:

i. Standard tare weights for 7-axle B-train units are 40-42 kips, and for 8-axle A-trains are 42 kips.

ii. The standard tractor wheelbase is 220 inches.

iii. Kleysen operations cannot justify breaking-up double-trailer units at the Manitoba-Ontario border (ie, operating at 140 kips in Ontario, but splitting the unit at the border for final delivery to Winnipeg).

Regulatory changes considered desirable by Kleysen include:

i. Kleysen would like to see a relaxation of the 16.75 m kingpin-to-rear limit.

ii. The carrier would also like the Prairie provinces to allow triple axles, up to a weight level of (about) 44 kips.

iii. Kleysen would like the normalizing of the western Canadian GVW level at (at least) Manitoba's 125 kips, with no distinction however between A and B-trains.

5.2 ARNOLD BROS. TRANSPORT LTD.

Arnold Bros. is an irregular route general freight carrier, specializing in TL shipments. The company has its head office in Winnipeg and terminals in most provinces. Movements between Ontario and the three Prairie provinces dominate Arnold's business. Operations into B.C., Quebec and the Maritimes are relatively minor; U.S. operations account for about 15% of its activity. The Ontario-Western Canada operation dominates decision-making respecting fleet design and selection.

The company's trailer equipment is illustrated in Figure 5.2.1. Two types of configurations dominate the fleet: standard 5-axle tractor semitrailer (3-S2) units (vans, flatdecks, stake and rack, lowbeds and hopper bottoms); standard 7- and 8-axle A-trains (3-S2-2 and 3-S2-3) (pup vans and hopper-bottom train sets). Arnolds also has some standard B-train (3-S2-S2) equipment (flatdecks and hopper bottoms) as well as tri-axle flatdeck and lowbed trailers for specialized hauling.

Two factors which continue to discourage wide-scale use of double trailers within and to/from Ontario are: *most major shipping and receiving facilities in Ontario are designed for the handling of one trailer per tractor; and Ontario roadway geometry (ie, more hills than in the Prairies) favours the use of the generally more stable and controllable single trailer configurations. Also, doubles are generally operationally inefficient in much of the TL general freight business because of their excessive vehicle handling requirements and maneuvering difficulties.*

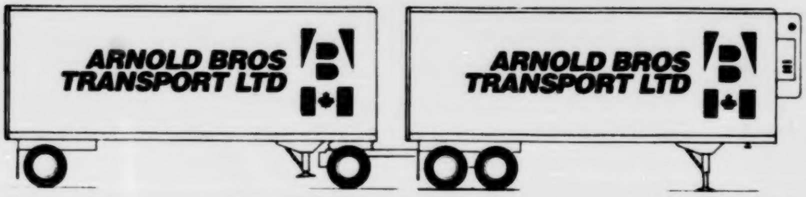
Arnolds is very sensitive to the effects of weight and dimension regulations on the ability of the trucking industry to compete with rail and pool car operations. In this regard, Arnolds argues that the real incentive for the trucking industry to adopt more productive (ie, larger) equipment is that in so doing it can increase market share (ie, effect mode shifts from rail or pool car to trucking), providing new opportunities for increasing profitability (lowering unit costs by increasing vehicle utilization; realizing certain scale economies; etc.). Arnolds provided the following observations relating to some of these competitive considerations:

i. Pool car operations are seen as a major competitor (today) on traffic moving between southern Ontario and Winnipeg. For example, current rates on steel moving from Stelco in Hamilton to Winnipeg are:

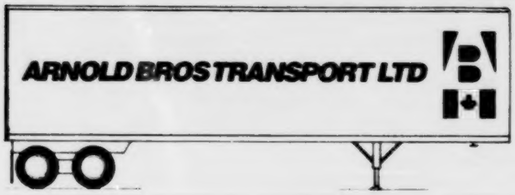
pool car	$2.90/cwt,	50-kip minimum
rail	$3.36/cwt,	100-kip minimum
truck	$3.60/cwt,	70-kip minimum

Pool car operators have been able to offer this type of rate by using steel as a base load, and "topping-up" with LTL -- to a substantially higher total payload than truckers can achieve under the best of circumstances on this traffic lane (ie, 80 kips). The general point to note about this competitive situation is that understanding the effects of VWD regulations on truck fleets and operations requires a strong appreciation for the nature of competition on the particular traffic lane.

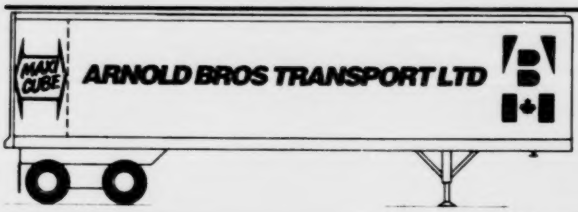
ii. Traffic lanes within the Prairie region to the west of Winnipeg are not nearly as modally competitive as is the situation to the east for general freight. Thus, for example, pool car operators are not viewed as a major competitor for trucking between Winnipeg and Saskatoon or Edmonton.


ARNOLD BROS TRANSPORT LTD
ARNOLD BROS TRANSPORT LTD

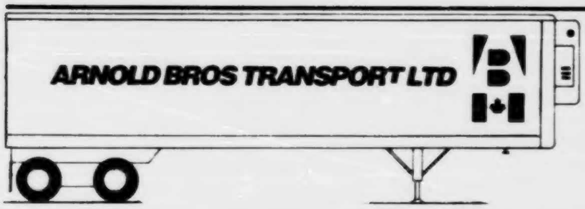
PUP DRY VAN


ARNOLD BROS TRANSPORT LTD

DRY VAN*


MAXI CUBE
ARNOLD BROS TRANSPORT LTD

MAXI CUBE DRY VAN*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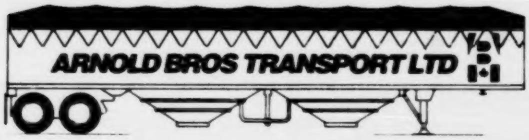
REEFER VAN*

MEAT RAILER*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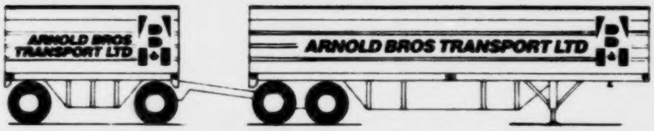
DRY BULK CARRIER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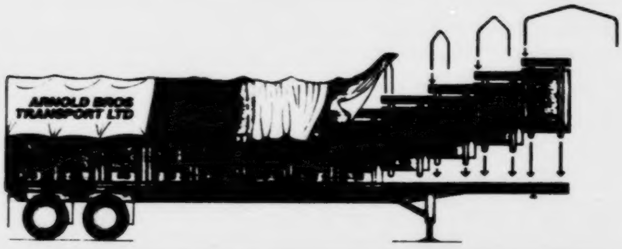
BULK A-TRAIN


ARNOLD BROS TRANSPORT LTD

STAKE AND RACK TRAILER

Arnolds observed that tariff structures are often slow, reluctant or "lumpy" in acknowledging cost differentials associated with handling TL shipments in semi-trailer versus train-lot sizes. This can often be due to what might be called "market-place sensitivities" associated with creating cost-based rate structures which might be interpreted as dis- crimination against one shipper relative to another. To this effect, shippers often have trouble understanding why their shipment size isn't the "right" one to receive optimal treatment in a tariff structure. This concern can be particularly important on interjurisdictional movements where -- depending on what jurisdictions are traversed -- different shipment sizes are possible. An example of this would be a steel shipper from southern Ontario into Western Canada having trouble understanding why a carrier would offer an 80-kip rate into Manitoba at (say) a 3% saving over a 70-kip rate, but offer only a 70-kip rate into Saskatchewan, because of GVW limits prohibiting carrying 80-kip payloads into that province. In practical terms, it is often more acceptable to simply offer one rate to both provinces, rather than complicate the tariff for reasons that are difficult to explain to the shipper.

One new example of slowness in introducing cost-based differentials into truck tariffs is the case of "concrete products", where train lots (ie, 70-kip minimums) are given *(only)* a 10% differential relative to semitrailer lots (ie, 45 kips). This compares with differentials of 20- 25% in petroleum hauls.

Arnolds uses wide-spread tandems on van equipment operated intra- Ontario -- 72" spreads on trailer tandems and 60" spreads on tractors, providing for a gross of 93,000 lbs. (12,000 on the steering axle, 39,000 on the drive axle and 43,000 on the trailer tandem) and payloads of up to 63 kips. Otherwise, Arnolds has generally stuck with 49" tandems on their fleet. The wide-spreads cost an additional $600 for a 3-S2 unit, but provide a 13 kip payload advantage for the life of the equipment -- with a relatively minor increase in tire wear.

Forty-eight foot vans are highly attractive for cubic traffic -- providing a 6% cube and revenue advantage over a 45' unit (if fully utilized), at a unit cost increase of (roughly estimated) 1.8%.

Other comments developed during discussions with Arnolds include:

i. Arnolds will not necessarily be adopting 48' vans for reefer operation, basically because the 45' units are weighing-out now. The one factor that may change this is related to re- sale value considerations; to this effect, 48' units are rapidly emerging as the industry norm and, rationally or otherwise, the major type of unit being sought after by prospective buyers.

ii. Typical tare weights are:

tractor	-	17,900 lbs.
48' dry van	-	13,300 lbs.
A- and B-train trailer sets	-	21,000 lbs.

iii. Arnolds suggested that an important policy issue may be emerging with respect to circumstances under which truckers may obtain over-weight permits for the handling of containers. They suggest that some enforcement agencies are issuing over-weight permits for the handling of containers on the grounds that the "shipment" (ie, the container) cannot be broken down, whereas if the same traffic were to be loaded into a van at the origin, it would be prohibited from movement because it could be broken down.

5.3 PAULS HAULING LTD.

Pauls is a TL carrier specializing in the movement of bulk petroleum, dry-bulk fertilizer and grain in hopper-bottom equipment, compressed gases and other commodities. It has its head office in Winnipeg and terminals throughout the Prairie provinces, and operates in the western U.S., the territories and north-western Ontario. Pauls has over 500 tractors and 800 trailers.

Two aspects of Pauls' operation are described here: the petroleum haul, and an example multi-jurisdictional movement of dry-bulk commodities using hopper-bottom equipment.

5.3.1 Petroleum Haul

Pauls introduced double-trailer combinations into its operations in the Prairie provinces in the mid-seventies, soon after the effective use of such equipment became feasible as a result of regulatory changes introduced as part of the Western Canada Highway Strengthening Program. Pauls has relied primarily on 7-axle A-trains (Figure 5.3.1) for three basic reasons: (a) when the equipment was initially purchased (1975), B- trains were rare; (b) A-trains offer important operational flexibility relative to B-trains; and (c) since 1982 A-trains have had a payload advantage relative to B-trains for operations in Manitoba. The flexibility issue is particularly important for Pauls because of its requirement to assign vehicles into operations between Manitoba and northern U.S. states (where 80 kip limits prevail on interstate highways, and Bridge Formula B applies off the interstate). The A-train can be adapted easily to both situations, first by dropping the pup and thereby becoming a standard 3-S2, or by adjusting tongue length to maximize loading possibilities under Bridge Formula B. Also, an important consideration when Pauls first purchased this equipment, this flexibility to convert from a 3-S2-2 to a 3-S2 was required in the Prairie provinces where doubles could only be used effectively on the primary highways. Truck-plus-trailer combinations have never been viewed as a feasible option by Pauls (or any other major petroleum hauler in Western Canada), presumably because of operational difficulties which would result from down-time on the power units.

The A-trains employed by this carrier have undergone two major modifications since their purchase in 1975. First, the trailers were initially designed to handle 7,700 gallons in the lead trailer, and 3,000 gallons in the pup. (The lead trailer capacity of 7,700 gallons has never been able to be effectively used.) This arrangement permitted weigh-out operations handling gasoline pursuant to the then prevailing 110 kip GVW limit in Western Canada. The units also had retractable/extendable

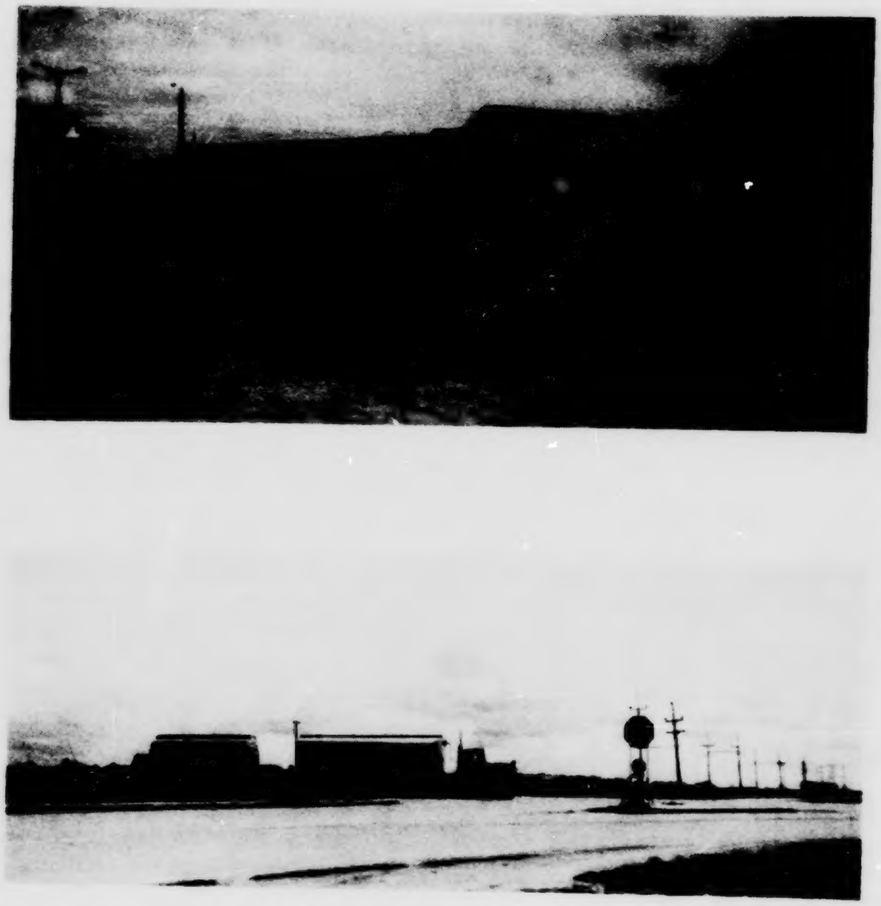


Figure 5.3.1 Pauls Hauling: Petroleum Tankers — A-trains

tongues, permitting them to be shortened to a 68.5' for Ontario operations (the then prevailing Ontario length limit), or stretched so as to obtain the required spread between the rear axle of the lead trailer and front axle of the pup to permit full axle weight loads and GVW in Manitoba. Upon the relaxation of Manitoba's GVW limit (to 125 kips) and Ontario's length limit (to 23 m), most of the pup trailers were lengthened from 177 inches (3,000 gallons) to 240 inches (4,000 gallons), with the variable tongue length requirement becoming redundant. *(The picture in the lower part of Figure 5.3.3 shows the new pups with the added section in the middle of the tank.)*

This carrier would have to add an additional axle to the pup trailer of these units to permit increasing operating GVW's from 121 kips to the current Manitoba GVW limit of 125 kips. The additional axle would add about two kips to the vehicle's tare weight, and provide a net gain of (maybe) 2-3 kips in payload. This is not considered an adequate prod- uctivity gain to justify the additional capital cost and operating costs associated with greater tire and fuel requirements, given an eighth axle. This position is considered particularly true given that the carrier can operate the 7-axle units under a 10% axle weight premium allowance in Manitoba between December and January (up to the GVW limit of 125 kips), but would not be permitted to carry extra load on the 8-axle unit (in that it would already have weighed-out at the 125 kip GVW limit).

Figures 5.3.1 and 5.3.2 contain photographs of Paul's standard petroleum equipment. The top picture in Figure 5.3.3 illustrates differences in the petroleum tanks used by Pauls; newer equipment has a lower profile, made possible by increases in allowable length limits for combination units in Manitoba since the time of purchase of the original equipment.

Information provided by Pauls indicates that as of June 1, 1986, rate differentials of about 21% and 18% exist between train-lot and semitrailer-lot shipments, for gas and diesel respectively. These differentials have increased with time, from about 9% in 1977, to about 14% in 1980, and to 18-21% today. Part of the explanation for the most recent increase in the differential is associated with the 1982 Prairie provinces' GVW increase from 110 to 118 (125 in Manitoba) kips. The mileage revenue figures are calculated assuming minimum payloads required for application of particular rates; in fact, payloads would normally be substantially higher than these minimums, leading to higher per mile revenue than the figures shown. In this regard, typical Manitoba train- lot payloads on primary highways are 52,000 litre (gas) and 43,500 litre (diesel).

5.3.2 Hopper-Trailer Operation

Pauls operates a 7-axle A-train hopper-trailer operation from its terminal in Brandon that involves (or may involve) the following handlings:

i. A vehicle dead-heads from Brandon to Rocanville.

ii. Potash is picked-up in Rocanville for movement into Idaho.

iii. The unit dead-heads from Idaho to Wyoming.

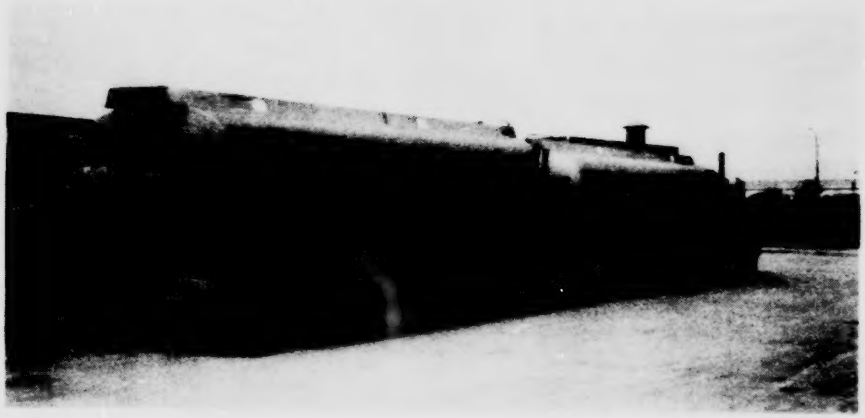


Figure 5.3.2 Pauls Hauling: Petroleum Tankers — B-trains

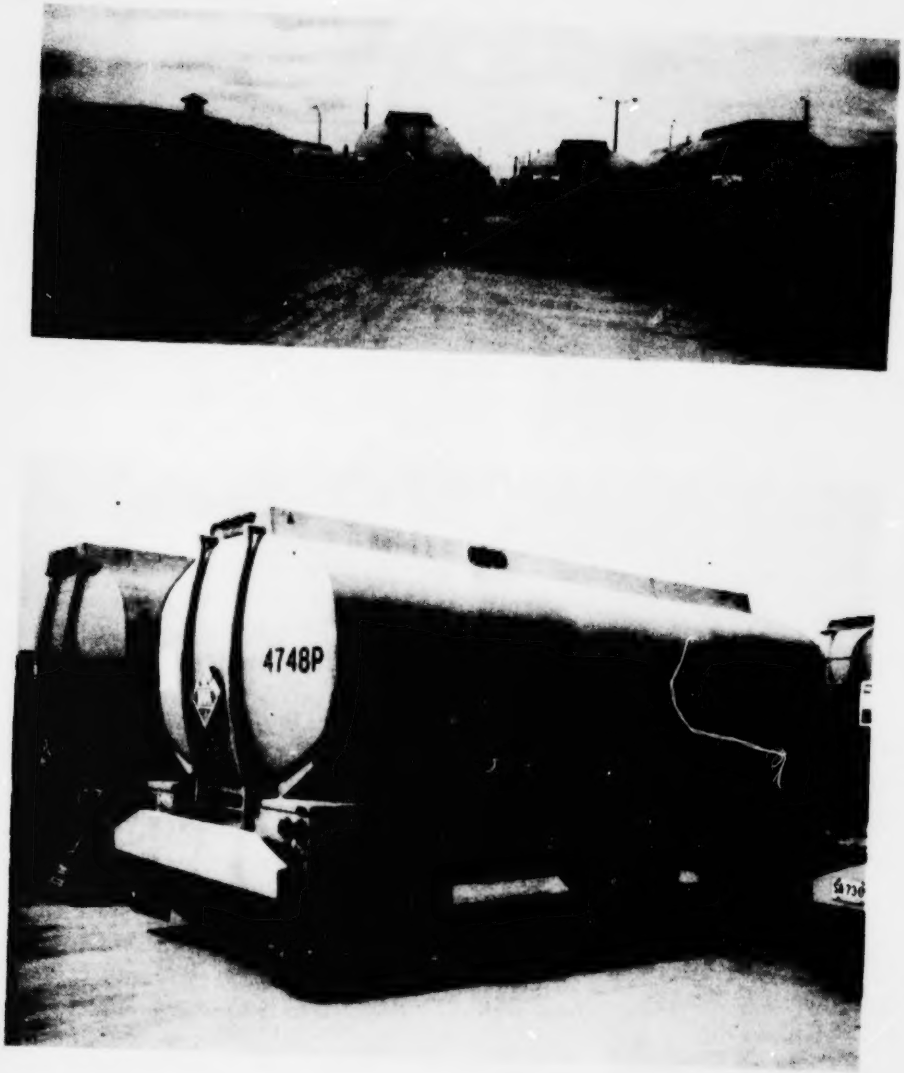


Figure 5.3.3 Pauls Hauling: Petroleum Tankers — Changes

iv. Soda ash is moved from Wyoming back to Brandon.

v. The soda ash is re-loaded into pneumatic equipment in Brandon for delivery to Thompson.

Legs (ii), (iii) and (iv) are subject to a GVW limit of 105 kips, pursuant to Bridge Formula B. The train's normal length is about 75 ft, with a 3.5 m spread between the dolly axle and rear-most axle on the semitrailer. When the unit arrives at the U.S. border after departing Rocanville, its tongue is stretched by 10 ft. to comply with Bridge Formula B requirements for U.S. operation. On re-entering Canada from Wyoming, the unit is shortened by 10 ft. for the movement into Brandon.

5.3.3 Incidental Comments

Other comments developed in discussion with Pauls are:

i. Standard tare weights for both 7-axle A and B-train petroleum tanker combinations are 40 kips.

ii. The standard tractor wheelbase is 185 inches.

iii. Pauls would like to see combination length limits increased to (about) 80 feet.

5.4 TRANSX LTD.

Transx is a Winnipeg-based general freight carrier, operating both intraprovincially in Manitoba (in particular between Brandon and Winnipeg handling LTL traffic) and extraprovincially handling TL traffic (primarily between Winnipeg and Toronto, but also to the west of Winnipeg including, recently, into British Columbia, as well as to/from the U.S.). Over the years, Transx has been instrumental in the development of innovative equipment, including early versions of western Canadian B- trains, double-stacking double-trailer livestock equipment and retractable landing gears for trailers.

The Transx fleet consists primarily of 3-S2 configurations using 45' (and now 48') semitrailers and 7-axle A-train doubles of a 3-S2-2 configuration.

Transx transports frozen french fries from Carnation's plant in Carberry, Manitoba to Toronto. This product has a linear pelletized density of about 1,000 lbs./foot. Pallet sizes are such that a 45' (or 48') 3-S2 reefer can handle shipments of about 45 kips -- that is, where the trailer tare is 16 kips, the tractor tare is 17-18 kips, and the maximum GVW is 82 kips (although in practice such units are normally registered at 80 kips by Transx). On the other hand, 7- (or 8-) axle double-trailer combinations, using two 27' reefer pups, can only handle an additional four kips of payload given current pallet sizes (which leave two feet of dead space at the end of each trailer). This compares to their payload capacity of up to 80 kips, given a combination tare weight of about 45 kips and a maximum GVW limits of 125 kips on the Manitoba-Ontario traffic lane. Interestingly, even permitting the use of two 28' pups would add little to the actual payload handlings of this product because of palletization practices; 29' or 30' pups would be required to realize meaningful payload increases.

Transx is of the view that the effective use of doubles requires terminal drop operations and not pin-to-pin (from shipper's door to consignees door). Further, doubles are viewed as highly bothersome in situations requiring multiple pick-ups or drops.

Permitting the effective use of triple or tri-axles (ie, with loads of, say, 50 kips and a GVW of 100 kips on a 3-S3 unit, using 48' semi- trailers) would discourage the use of doubles in the Transx operation. Such units, offering payload capacities of about 65 kips and a cubic capacity similar to the effective cube of two 27' pups, are viewed as particularly useful for the transport of dense foodstuffs such as potatoes, canned goods, and beer. Transx considers that there exists an attractive and vulnerable rail market in this shipment size range.

American shippers are moving faster than their Canadian counter- parts in requiring the provision of 48 ft. vans; these are rapidly becoming the industry norm.

Prior to the 1982 relaxation of Manitoba's GVW limit to 125 kips from 110 kips, Transx regularly broke west-bound double-trailer units at the Ontario-Manitoba border, bringing the trailers into Winnipeg as singles. Under those circumstance the combination could be operated to the border at up to 140 kips; it is now deemed more efficient to limit the GVW on a double to 125 kips, running it straight through from the Toronto area to Winnipeg.

Transx operates double stacking, double-trailer combinations transporting cattle from Brandon/Winnipeg to south-central Ontario, handling payloads of about 65 kips (ie, at a gross of about 100 kips). The units are used to haul steel coil/plate back to the west, typically handling payloads of 75-80 kips.

5.5 PENNER INTERNATIONAL INC.

Penner is a Steinbach-based general freight TL carrier, operating primarily on an extraprovincial basis in an irregular route manner. The carrier operates in many jurisdictions, on and off primary highways, pursuant to many different regulatory regimes. U.S. operations are a particularly important aspect of Penner's business; as such, its units are regularly required to comply with 80 kip GVW limits on the interstate system and Bridge Formula B.

The Penner fleet consists totally of 3-S2 configurations using primarily 45 ft. semitrailers. (There are few 48' semitrailers and no train sets.)

An important component of this carrier's operation is the movement of auto parts in TL lots from southern Ontario into the four western provinces, lumber from Western Canada and northwestern U.S. back into the Prairie region and on, and miscellaneous TL loads (such as manufactured windows) from the west into north central and eastern U.S. The carrier uses standard 45' and 48' 3-S2 units to service this network -- a vehicle combination which has a substantially lower payload capacity than could otherwise be achieved on the Canadian portion of this network given the use of double-trailers. There are four reasons why this equipment is used (and why doubles are not):

i. Much of Penner's traffic which requires U.S. routing can be loaded to 80 kips using a single trailer; since the U.S. operation is often restricted to 80 kips, there is no need to employ doubles.

ii. Even where traffic cubes-out, the extra cube associated with two 27' pups versus one 48' semitrailer is seldom effective for general freight TL operations. That is, more cube may be lost in loading two pups -- say 3' per pup -- than in loading one trailer -- say 2' per 48' semitrailer -- leading to a total effective linear cube in the doubles of 48' versus 46' in the single. In other words, two 27' pups may only have a cube advantage of two feet over a 48' semitrailer.

iii. The carrier's major Ontario customers' terminals are designed to handle single-trailer-per-tractor operations, effectively preventing the use of double trailers. (One major customer specifically prohibits being serviced by doubles.)

iv. Many of this carrier's clients "think" of their operations in terms of 45' or 48' vans carrying payloads of 45-50 kips; converting their thinking in order to make the changes necessary to use doubles is considered difficult.

Forty-eight foot semitrailers have become the industry norm; although there are some difficulties in handling such equipment, particularly in some of the older more established areas such as Chicago.

Penner indicated that, given a 140 kip GVW limit in Manitoba, they would consider adding some doubles into their fleet to permit rail- competitive handling of products such as glass from Ontario into the Manitoba market.

On weigh-out operations across the international border, Penner's drivers must regularly slide fifth wheels to move from a 12-34-34 kip distribution in the U.S. to a 10-35-35 distribution in Canada. All tractors are accordingly equipped with air-slide fifth wheels (at an added tare weight of about 200 lbs.). To further facilitate load distribution, all trailers are equipped with moveable tandems (additional tare weight of 350 lbs. per trailer). A knowledgeable driver can effect the required redistribution in about 15 minutes. In practical terms, many drivers like to "stretch" their vehicles whenever they can (ie, everywhere but at scale sites), leading to substantial difficulties with axle over-weights. *(Apparently large U.S. fleets don't use "slider" equipment to the extent such is used in Canada, basically to save tare weight and additional expense).*

Other incidental comments picked up during the course of the discussions with Penner include:

i. Penner uses 55" tandem spreads on tractors and 60" on trailer tandems. The 60" tandems are being adopted in anticipation of regulatory changes which would increase tandem-axle weight limits in Saskatchewan and Manitoba to (say) 37 kips given the use of wider spreads (as in B.C. and Alberta).

ii. Typical lumber loads from B.C. to Steinbach are 50 kips, with the tare on a 3-S2 with a 48' semitrailer being 32 kips (carrying 300 gallons of fuel).

iii. The standard tractor wheelbase is 222 inches. All newly purchased tractors are now CBE, because of their higher resale value relative to COE.

iv. All newly purchased trailers are FRP (fibre glass). While the fibre glass units weigh about 1,000 lbs. more than standard aluminum trailers (having a tare weight of 13 kips), they require less maintenance and are considered to be more attractive.

v. Penner uses 11" radial tires on all axles, with the drive and steering axles getting the new tires, and the old tires being placed on the trailers. These 11" radial tires have the same nominal width as the old 10" bias ply tires.

5.6 REIMER EXPRESS LINES LTD.

Reimer is a Winnipeg-based carrier specializing in the transportation of general freight -- and in particular LTL general freight -- on an extraprovincial basis from British Columbia through to Quebec. The carrier has terminals in Vancouver, Calgary, Edmonton, Saskatoon, Regina, Winnipeg, Kenora, Dryden, Thunder Bay, London, Toronto and Montreal. The description here deals with the equipment issues of direct interest to Reimer Express Lines Ltd., ignoring the interests of a number of other affiliated operations specializing in other aspects of the trucking business, including courier services, TL general freight, heavy haul and bulk petroleum.

Reimer has the following types of trailers in its fleer: dry vans: 26', 27', 45' and 48'; reefers: 26' and 45'; dry insulated 26' pups; and, 45' stake and rack.

The 26' pups were the original double-trailer units adopted by Reimer in response to the regulatory changes introduced by the Western Canada Highway Strengthening Program. Using short wheelbase, COE tractors (142") and a (tight) 36" spacing between trailers, two 26' semi- trailers could be operated within the original 65' length limit specified for such combinations. The three-foot spacing between pups was trouble- some when reefer units were used at the rear of a combination, in that they decreased effective spacing to 12-18", leading to hitting of the two trailers on turning maneuvers.

With Ontario's relaxation of length limit in 1982, Reimer adjusted its doubles as follows: (a) they introduced 27' pups; (b) they replaced short wheelbase tractors with longer, conventional tractors with 210-214" wheelbases; and (c) they lengthened hitches to four feet. The longer tractors have the following advantages: lower maintenance costs; greater stability in the operation of the configuration; better aerodynamics; and, improved driver comfort. The combination is designed to fit comfortably within the overall 23 m length limit specified by the provinces within which Reimer operates. At the same time, the unit is designed to comply with the

16.75 kingpin-to-rear limit (ie, 27' - 3' kingpin setback + 4' + 27' = 55' or 16.75 m). It is pertinent to note that Reimer had some trouble with some of the units delivered to them in the spring of 1986, in that the hitch lengths happened to be 49.5 inches, making the kingpin-to-rear length 55'1.5". These excessively long combinations (ie, by 1.5 inches) were initially prohibited from operation in Manitoba, and Reimer was obliged to break-up a number of them at the Ontario-Manitoba border (Westhawk scale) to permit them to be brought into Winnipeg.

Reimer has recently begun to specify 72" and 60" spreads for its trailer and tractor tandems respectively. The reason for this (apparently) is an expectation that higher tandem-axle loads will be permitted for wide spreads as a result of the RTAC study.

Reimer's doubles are all configured as A-trains. B-trains are considered impractical for Reimer's type of general freight operation, for three reasons: (a) inflexibility in mixing trailers; (b) need for sliding fifth wheels on the lead trailers to facilitate end loading/ unloading; (c) weight distribution problems (given a requirement to use tandem-axle centre groups as per Prairie province regulations).

Doubles are feasible on the longer runs common to the Reimer operation. Reimer would consider them less feasible in, for example, intra-Ontario operations, where shorter runs are much more common. To this effect, the time and trouble associated with maneuvering doubles would be too great relative to linehaul operation in short distance markets.

Reimer's typical double-trailer configuration is a 3-S2-2, with 3.5 m spreads between the rear axle of the lead trailer and the dolly axle, and between the dolly and the rear axle of the rear trailer. Such a unit can operate in Manitoba at (up to about) 121 kips, and in Saskatchewan and Alberta at 118 kips. Generally, however, the tractors are registered for only 115 kips, in that the vehicles are seldom (if ever) loaded to their weight limits given the nature of Reimer's traffic. The only reason that Reimer would want to (sometimes) use an 8-axle (3- S2-3) configuration is to provide for greater flexibility in loading (ie, reducing load distribution problems sometimes experienced with the 7-axle units).

Other incidental comments picked up during the course of discussions with Reimer include:

i. Typical tare weights are:

48' reefer with insulation	-	21,740 lbs.
45' reefer with insulation	-	19,560 lbs.
27' tandem-axle reeefer with insulation	-	14,900 lbs.
214" tractor (with fuel and driver)	-	20,000 + lbs.

ii. All new large vans are 48' although such units are really not productive for reefer traffic, in that they are simply reducing payload capacity by the amount of their incremental tare weight over 45' vans.

iii. Reimer currently uses tractor front axles rated at 12,000 lbs., although they are generally operated at maximum loads of 10,000 lbs.

iv. Reimer has experienced some difficulty in the loading of frozen products and hanging beef moving from Manitoba to southern Ontario and Quebec. Shippers want these movements to be handled in straight trailers (pups are not liked at destination), in payloads of 42-43 kips. Typically, however, Reimer can handle loads of only about 38-39 kips in their 48' semitrailers (80 kip GVW -20 kip tractor tare - 21.7 kip trailer tare = 38.3 kips). Apparently the difficulty with the obvious (at least partial) solution to this problem -- registering the vehicles at 82 kips -- is that there is a problem in loading to the required 12 kips on the front axle.

The regulatory changes Reimer would like to see are as follows: (a) a relaxation or elimination of the 16.75 m kingpin-to-rear limit; (b) uniformity; (c) normalization of GVW limits between A- and B-trains (Manitoba); (d) regulatory changes designed to increase cubic capacity; (e) higher load limits given the use of wide spread tandems, and (f) uniformity of axle spreads and weights.

5.7 LODE-KING INDUSTRIES LTD.

Lode-King Industries Ltd. in Winkler is one of the Prairie region's major designers and manufacturers of hopper-bottom trailer equipment used in the transportation of bulk grain and fertilizers (including potash). Lode-King's production capacity is in the order of one train set per day.

Lode-King manufactures three basic hopper-bottom configurations: (a) 38', 40', and 42' tandem-axle semitrailers, for operation in standard 3-S2 configurations; (b) A-train sets, consisting of 32' or 34' tandem- axle lead semitrailers and 17' 2-axle pups, with a 8' hitch; and (c) B-train sets, with 25' lead and 28' rear semitrailers. Standard production is in steel, although aluminum trailers are available on special order.

Figure 5.7.1 shows an extendable tongue arrangement on an A-train; Figure 5.7.2 illustrates typical A-train hopper bottom sets operating in the west; Figure 5.7.3 contains drawings of various trailers built by Lode-King.

Train sets account for approximately 90% of Lode-King's output, most of which are destined for operation within and to/from the Prairie region. Single semitrailers -- accounting for only about 10% of the production run -- are largely destined for operation in Minnesota, where train sets cannot be effectively employed because of Minnesota's 80 kip GVW limit.

A-trains are more popular than B-trains for two reasons:

i. It is difficult to get the proper axle load distribution on B-train hoppers used for grain haul. For example, fertilizer must be loaded heavier toward the front and rear of the lead and back trailers, respectively, to achieve proper weight on the centre tandem axle. On the other hand, loading corn to the full cube of the B-train set leads to underloading

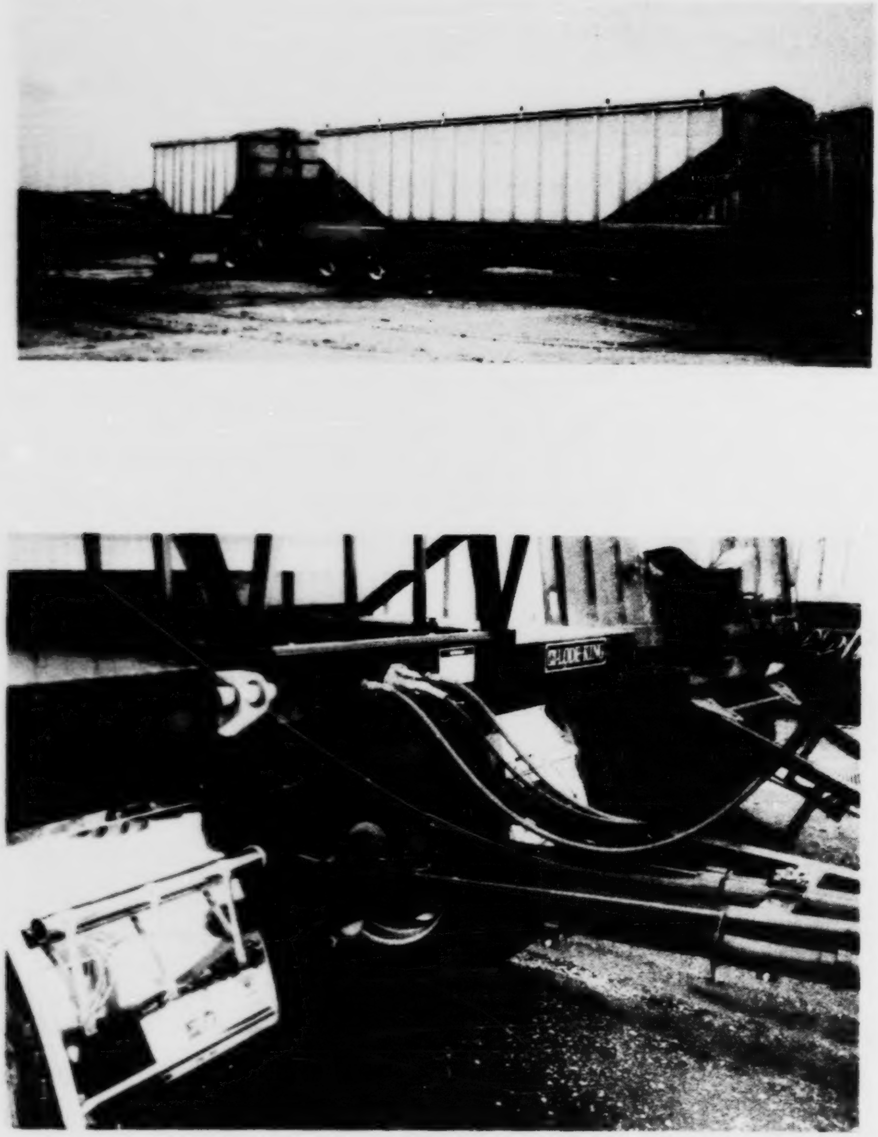


Figure 5.7.1 Lode King Industries: Extendable Tongues

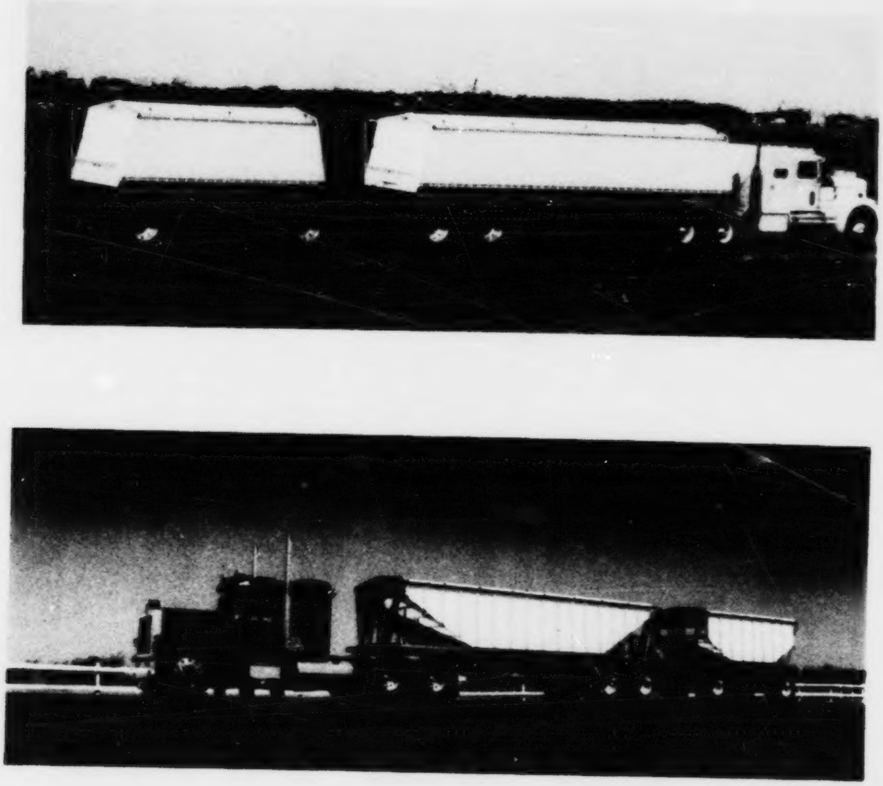
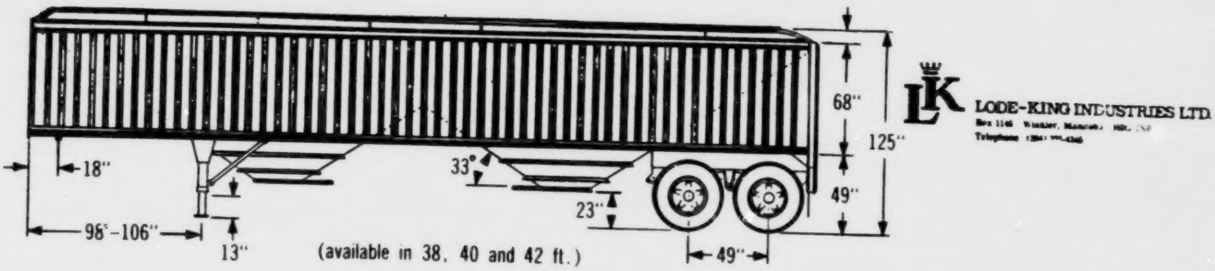
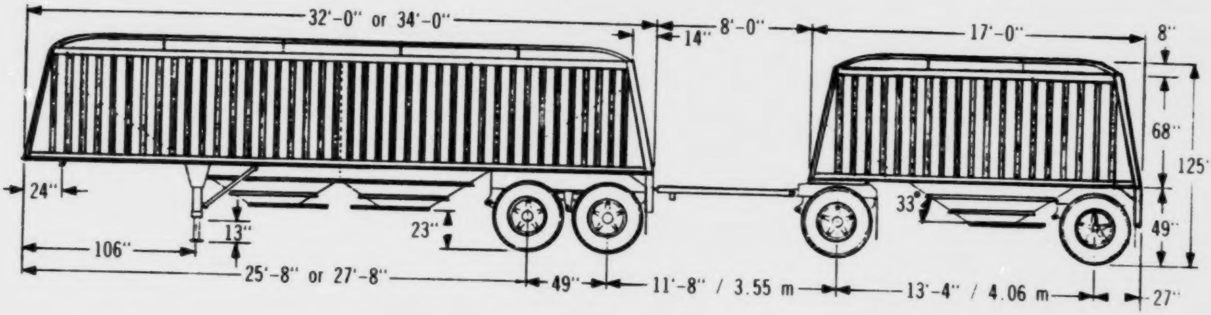


Figure 5.7.2 Lode King Industries: A-train Hopper Bottoms

STANDARD HOPPER GRAIN TRAILER


8"
68"
125"
49"
18"
33°
23"
98"-106"
13"
(available in 38, 40 and 42 ft.)
49"
LODE-KING INDUSTRIES LTD

HOPPER GRAIN A-TRAIN 57'-0"


32'-0" or 34'-0"
14"
8'-0"
17'-0"
8"
68"
125"
49"
24"
106"
13"
23"
33°
25'-8" or 27'-8"
49"
11'-8" / 3.55 m
13'-4" / 4.06 m
27"

HOPPER GRAIN B-TRAIN 56'-0"

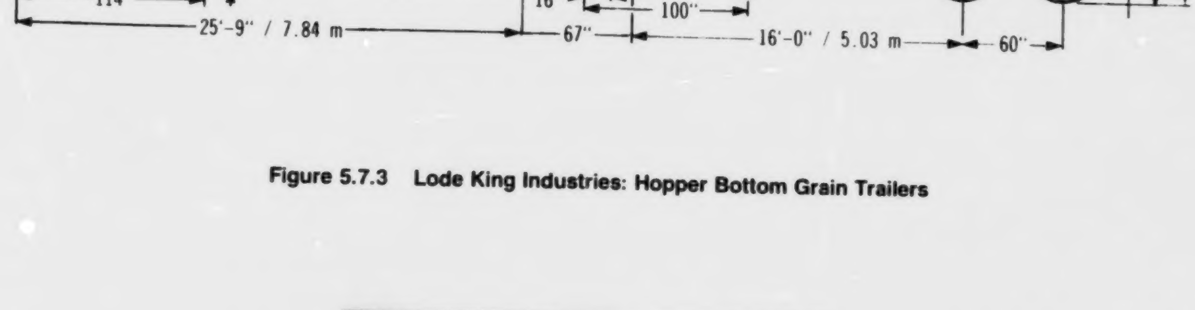

25'-0"
3'-0"
14"
27'-8"
8"
68"
125"
49"
30"
33°
23"
12"
114"
16"
100"
25'-9" / 7.84 m
67"
16'-0" / 5.03 m
60"

Figure 5.7.3 Lode King Industries: Hopper Bottom Grain Trailers

in total, but overloading on the centre axle. Providing baffling systems in B-train sets which can accommodate load distribution requirements of different commodities of different densities has proven difficult, and has led to a general reluctance to use B-train hoppers by Manitoba and Saskatchewan carriers. It is pertinent to note, however, that the B-train hoppers have been relatively more popular with Alberta-based carriers. Two reasons are given for this: (a) the principal hopper-bottom equipment supplier to the Alberta industry has promoted the B-train more aggressively; and (b) some carriers have indicated to Lode-King that -- at least in the past -- Alberta authorities have in the past been more lenient in the enforcement of axle weight distribution problems for this type of equipment and these commodities than have their counterparts in Manitoba and Saskatchewan.

ii. Canadian A-train configurations can be stretched in northern U.S. states to provide greater payload capacity that can be achieved using B-trains, as a function of each state's policy with respect to the application of Bridge Formula B. This is an important consideration in vehicle selection for any Canadian carrier contemplating or engaged in a significant Canada-U.S. movement of grain, fertilizer of potash.

The hitch length of the A-train is the **"big"** regulation-related issue pertaining to hopper-bottom trailers. At the request of customers, Lode-King has had to keep increasing hitch lengths to facilitate higher loading in U.S. operations.

In Lode-King's case, the basic hitch length is 8 ft. -- the length of which was selected to provide an 11'8" (3.55 m) spread between the rear most axle on the lead unit and the dolly axle. This resulting spread permits full axle loadings on these two axle sets throughout the Prairie provinces -- the principal area where the equipment is used. In practice however, all units are now sold with extendable tongues. In this regard, options include: 8 ft. + 30", 8 ft. + 60", or 8 ft. + 90" (no one is now interested in the + 30" option.) Some of Lode-King's competitors are offering 12' tongue extensions which, when fully extended, provide 20' hitch lengths. In the past, Lode-King used to offer a retractable hitch (8 ft. - 30"), bought primarily by Alberta carriers pre-1982, when a spread of less than 3.5 m was permitted.

In general, from a stability and control standpoint, Lode-King's view is that the shorter the hitch, the better. The most stable unit is the one employing the retractable hitch -- retracted; units with 20' hitches are not considered desireable.

Lode-King is of the view that the "smartest" hopper-bottom configuration possible from the safety perspective would be an 8-axle B-train, using a triple centre axle group, where a 45 or 50 kip load is permitted on the centre axle.

Lode-King discourages the use of tandem-axle dolly converters. They will not fill requests to manufacture 4-axle trailers to be hauled behind 3-axle straight trucks on the grounds that the resulting combinations are "inappropriate". *(Some of the large farming operations like the idea of 3-4 units, presumably because of their flexibility in use).*

Canadian hoppers are made of steel, unlike the situation in the U.S. where aluminum is standard. The steel units are required in Canadian grain hauling because of the more difficult conditions (weather and road) under which the units must operate, as well as ease of repair.

5.8 KLASSEN TRUCKING LTD.

Klassens of Winkler is an irregular route commodity carrier specializing in the transportation of grain and dry fertilizer (including potash) in hopper-bottom trailers. Its operations are concentrated on international movements between Manitoba and Saskatchewan and bordering states, and intra-Prairie region movements (principally within Manitoba and between Manitoba and Saskatchewan).

Currently, Klassens operates about 18 tractors and 22-28 trailers, all of which are operated as single trailers except for two A-train sets. The two A-trains are standard Lode-King equipment, and are used strictly for intra-Prairie region operation. All of the single hopper-bottoms are of either a 40' or 42' length, configured in standard 3-S2 arrangements. Klassens used to have three hopper-bottom B-trains but removed these from the fleet because of problems experienced with achieving proper axle load distributions (as discussed in the previous section).

Prior to the relaxation of Ontario's overall length limit from 68.5 to 75.5 ft, Klassens was obliged to cut the step of the rear trailer from its B-trains (ie, shorten the vehicle combination by 4") to comply with the Ontario regulations.

When operating into the U.S. from Manitoba, a 3-S2 unit must comply with the following spread requirements in North Dakota and Minnesota to operate at an 80 kip GVW (given a load distribution of 12/34/34 kips): (a) the exterior bridge -- the distance from the foremost drive axle to rear of trailer -- must be at least 51'; (b) the interior bridge -- the distance from the foremost drive axle to the rear of the trailer -- must be at least 37' in North Dakota on state highways, 39' in Minnesota on state highways, and 36' in Minnesota on interstate highways.

Other incidental comments developed in conversations with Klassen include:

i. Canadian shippers are now expecting 20-25% rate differentials between train- and semitrailer-load lots; U.S. shippers, on the other hand, expect only 10-15% differentials. As such, effectively all of the cost advantage of train-lot movements of grain and fertilizer is being passed-on to Canadian shippers.

ii. The design of a hopper-bottom for grain hauling is heavily governed by a requirement ot provide 33-35 degree slip angles. Any commodity, except for meat and fish meal, will self unload at this angle.

iii. Typical tare weights and new trailer costs are:

3-S2 hopper bottom	• 30 kips trailer cost	• $20,000
3-S2-2 (steel)	• 40 kips	• $34,000
3-S2-2 (aluminum)	• 34 kips	• $41,000

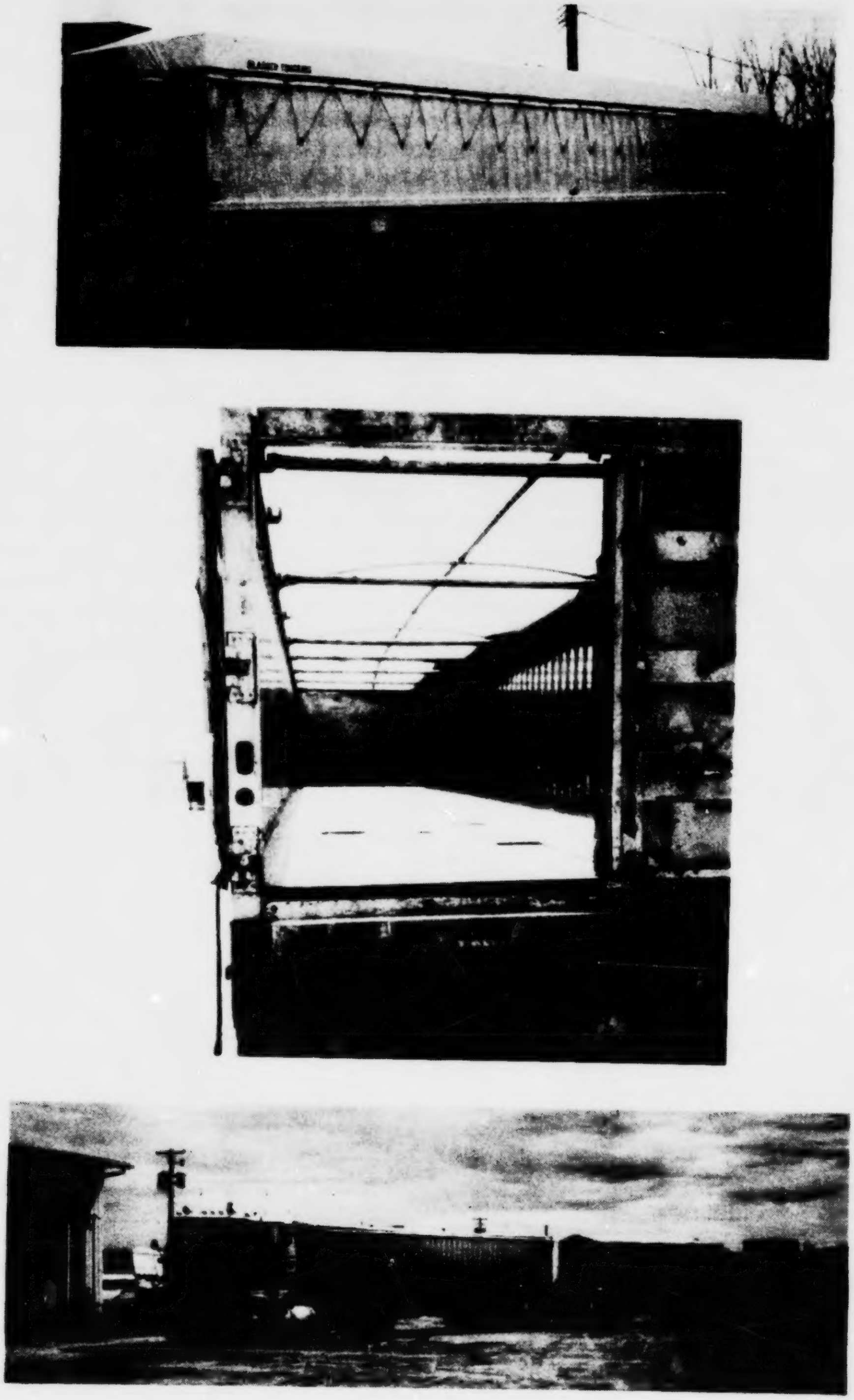


Figure 5.8.1 Klassen Trucking: Grain Trailers

iv. Truck-plus-trailer (3-4) combinations are feasible for grain hauling, and are being used in southern Manitoba in some private farm hauling.

5.9 OTHER MANITOBA CONFIGURATIONS

A 7-axle A-train (or a tractor-semitrailer-with-a-stiff-poled-pup-trailer) used for hauling gravel in Manitoba is shown in Figure 5.9.1. The assumed GVW is 53,500 kg -- assuming 5,500 kg is the maximum front-axle load on such a configuration and tandem axle loads of 16,000 kg. The point to note about Manitoba's regulations is that rather than the minimum 5 m spacing between each of these tandem-axle groups (ie, an inner spacing of 5 m), these end-dump-bulk trailers are only required to maintain a spacing of 4 m. A number of other 5- and 7-axle alternatives are shown in Figure 5.9.2, and a recent hopper-bottom design is shown in Figure 5.9.7. They are all governed by the requirement to have axle spacings of 3 m (or more) between front steering and tandem axles and 4 m inner spacings (or more) between tandem-axle groups. Failing this, there are load-reduction penalties that apply. The combination to take special note of -- as far as is know this is only seen on the prairies --is the 7-axle tractor-semitrailer-with-a-box-on-the-drive-axles. (A clearer picture from Saskatchewan is contained in Figure 6.6.1.)

In Figure 5.9.3, two examples of hopper-dump equipment are shown. Hopper-bottom equipment used for gravel hauling is shown in Figure 5.9.4-- the one at the bottom, although built in Manitoba, is presumably destined for some other jurisdiction (the 3-axle groups are not allowed in Manitoba, or, more correctly, no load greater than a tandem-axle load could be obtained by using such axle groups).

The typical LTL configuration, a 2-S1-2 is shown in Figure 5.9.5 - the top one from B.C. and the bottom picture from Alberta. Three Western B-trains (flatbeds) are shown in Figure 5.9.6 and more detail on these B-trains is shown in Figure 5.9.8.

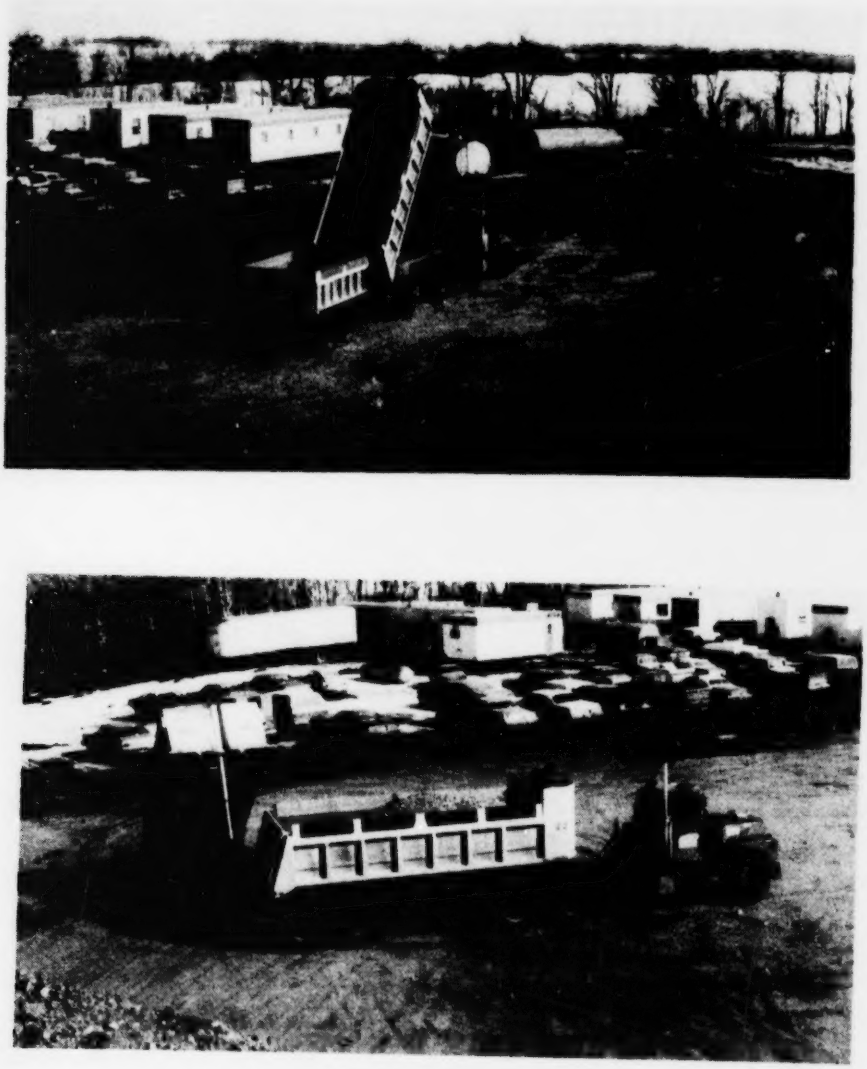


Figure 5.9.1 Manitoba Gravel Haulers: 3-S3-2 (pony)

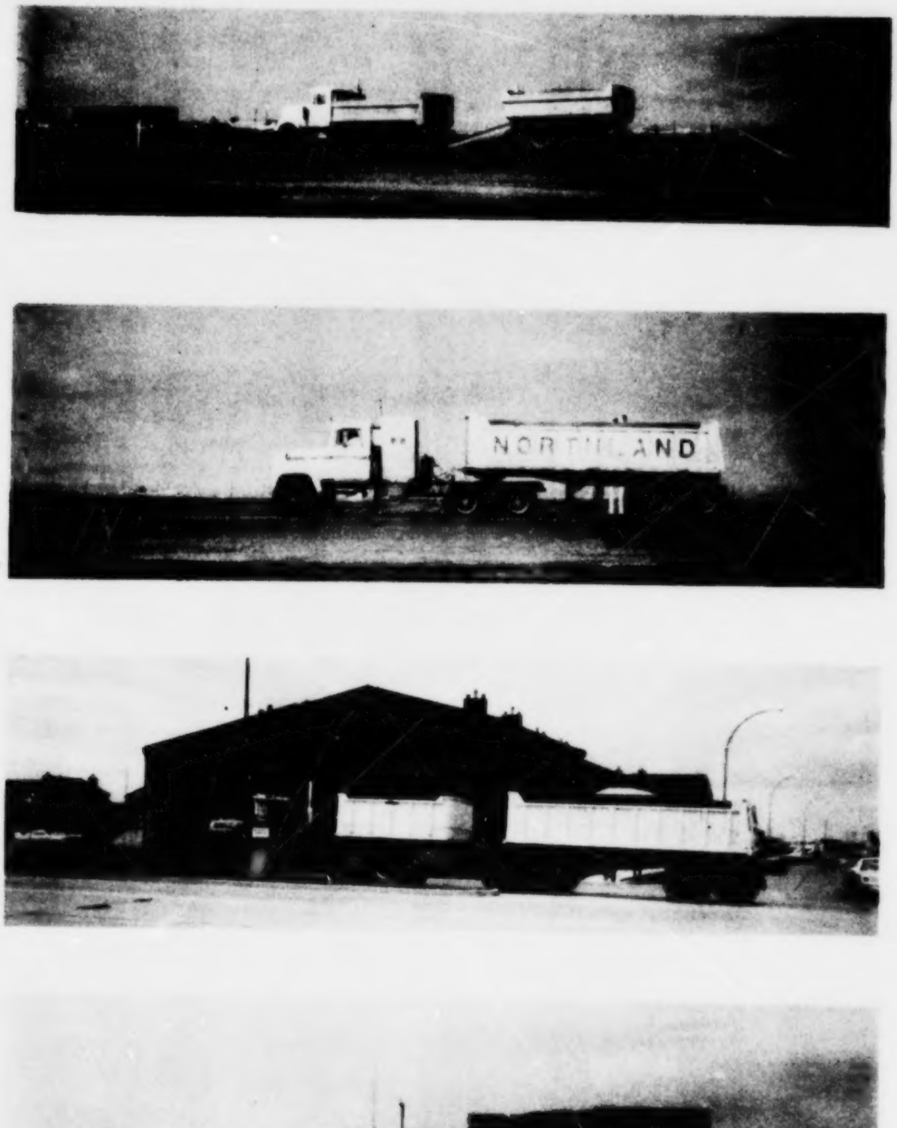
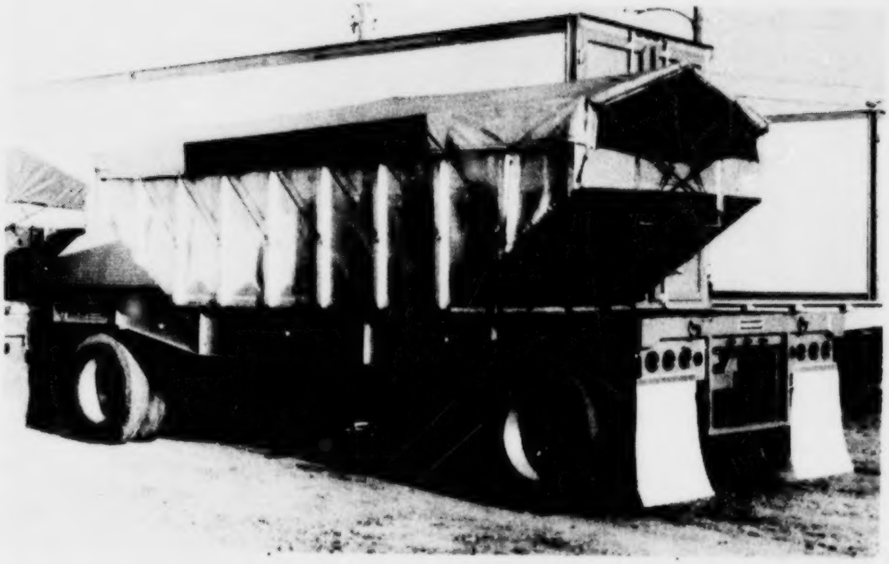


Figure 5.9.2 Manitoba Gravel Haulers



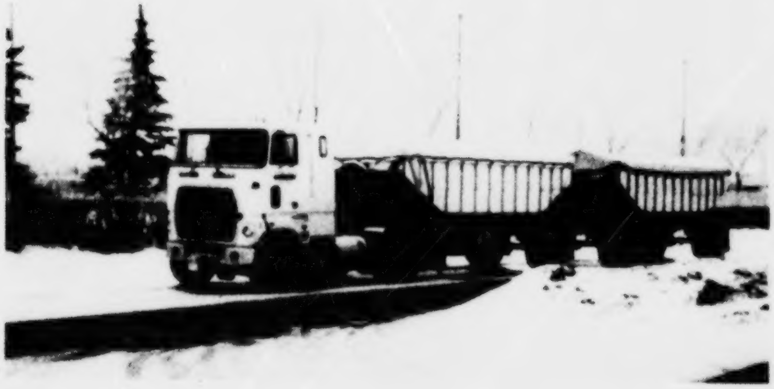


Figure 5.9.3 Western Canadian Hopper-Bottom Equipment

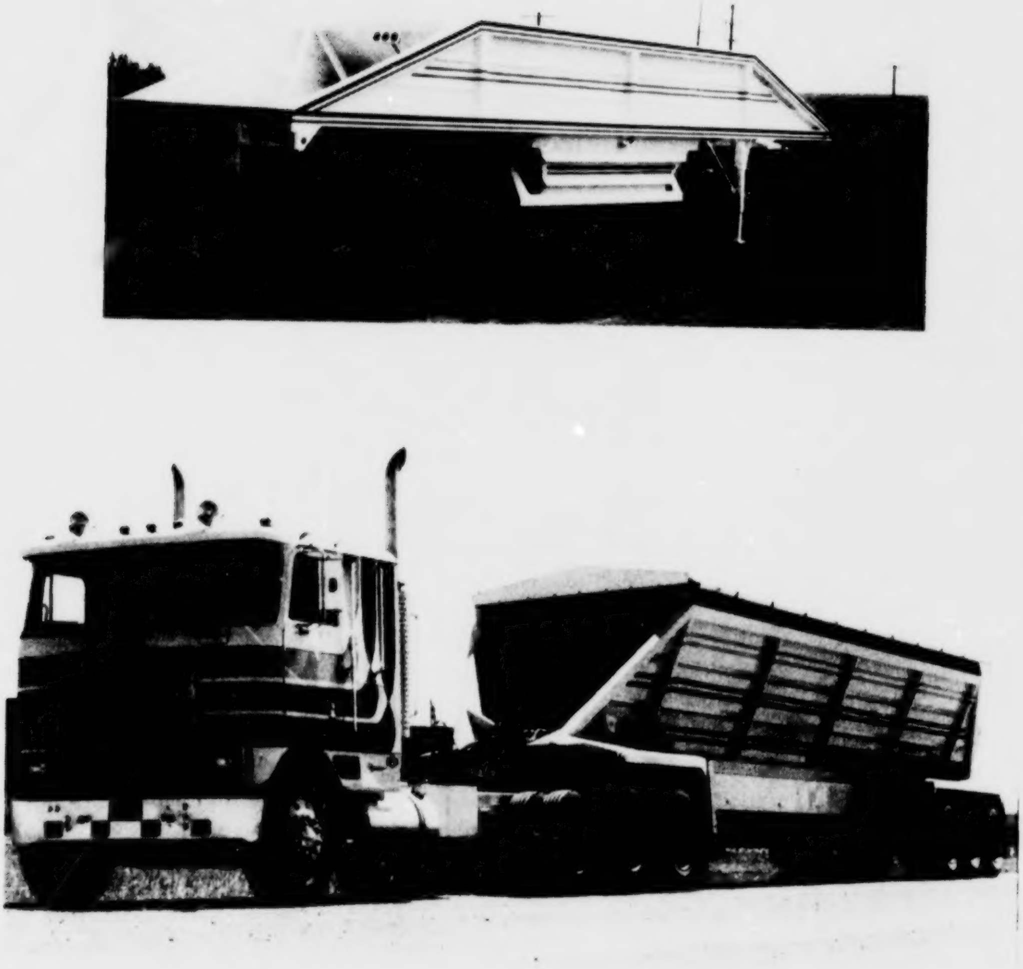


Figure 5.9.4 Manitoba Gravel Haulers: Hopper Bottoms

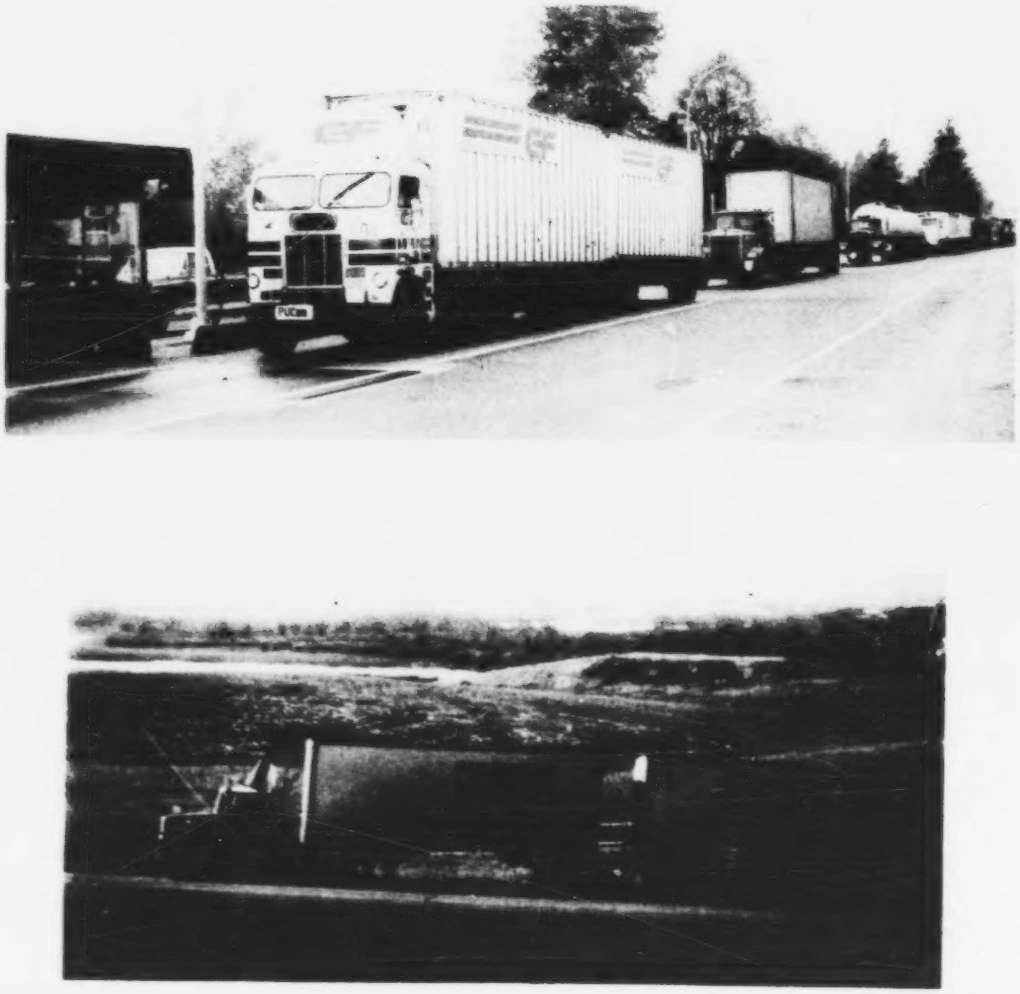


Figure 5.9.5 Canadian LTL Carriers: 2-S1-2

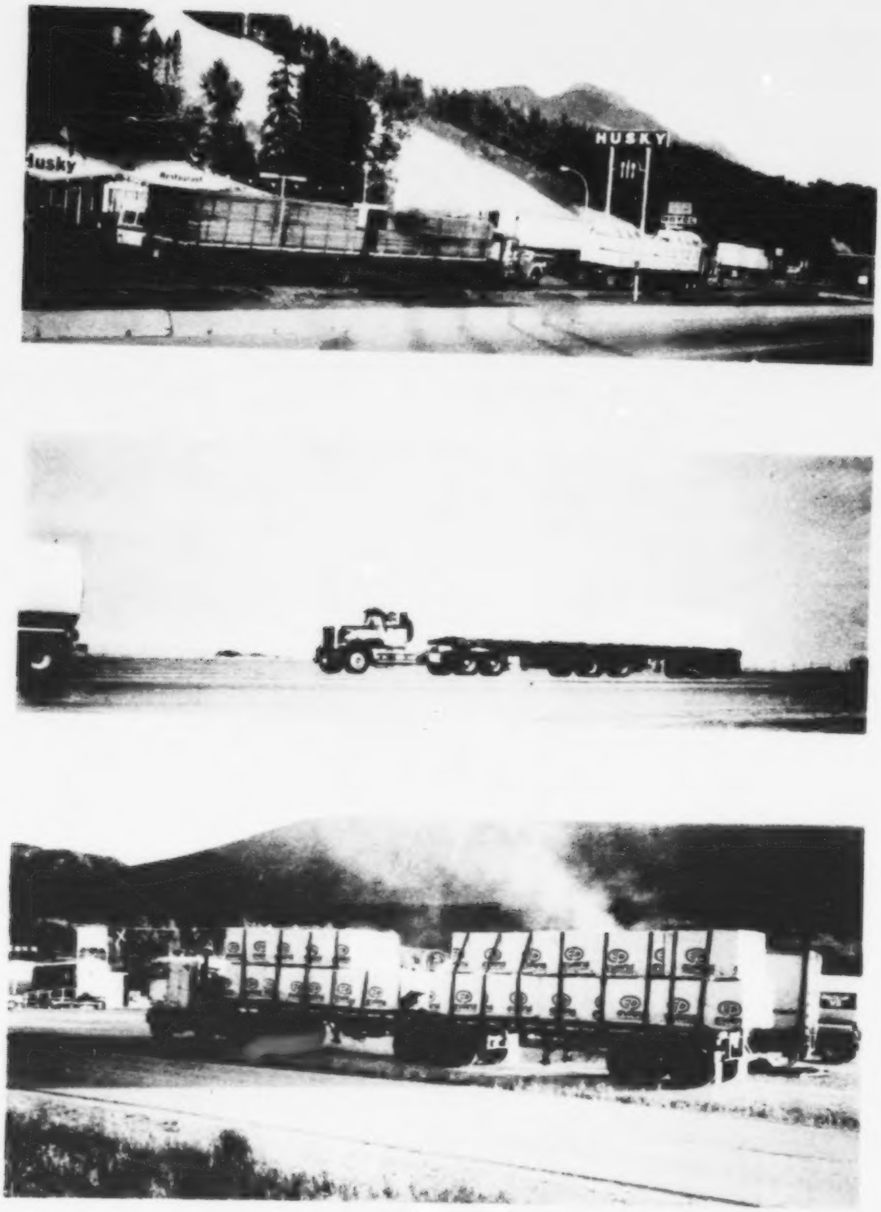
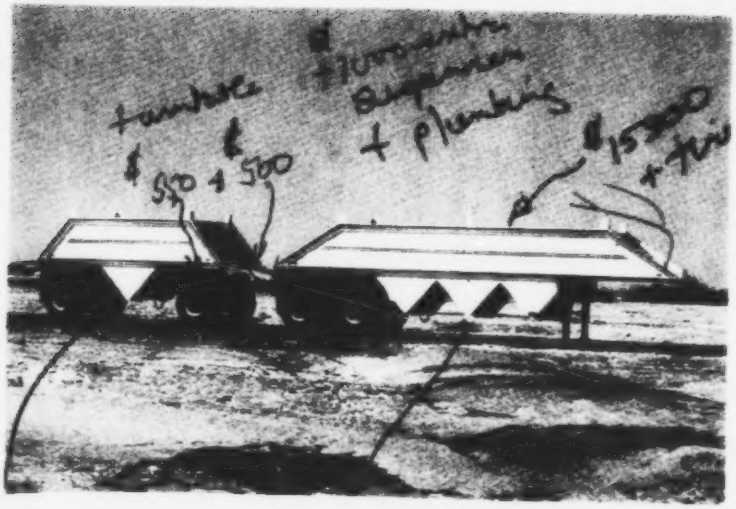

Husky
Restaurant
HUSKY

Figure 5.9.6 Western Canadian Flatbed B-trains



turntable

$ 550 + $ 500

$ 7000 extra suspension + plumbing

$ 15000 + tri

Figure 5.9.7 Manitoba Gravel Hopper Bottom

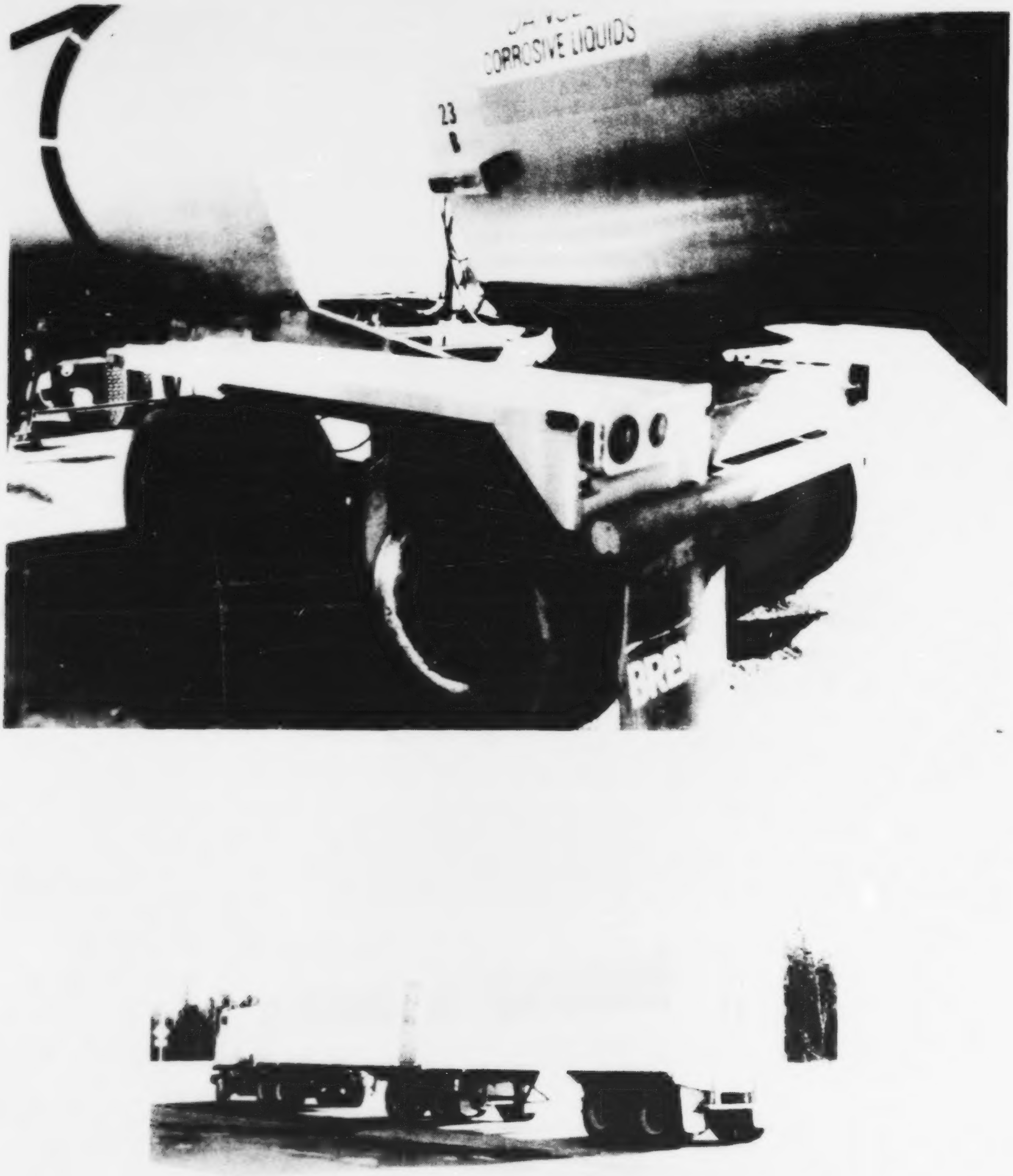

CORROSIVE LIQUIDS
23
BRE

Figure 5.9.8 Manitoba: B-train

6. Case Studies: Saskatchewan & Alberta

6.1 FEDERATED CO-OP LTD.

Federated Co-op operates a truck fleet to serve the Co-op retail distribution system throughout Western Canada hauling general freight (vans), lumber (flatdecks), and petroleum products (tankers). Vans and flatdecks operate throughout Western Canada, petroleum tankers operate predominantly in Saskatchewan, Manitoba, and southern Alberta and British Columbia. Federated operates (as of August 1986) 505 pieces of equipment: 98 tractors, 273 trailers, and 134 other vehicles (service trucks, etc.).

For its petroleum hauling, Federated uses 100 tank trailers configured in 40 train sets: six 7-axle B-trains, seven 8-axle C-trains, and the balance a mixture of 7-axle A- and/or C-trains.

For other freight, Federated uses 159 vans. Most of these are configured as conventional 5-axle tractor-semitrailers (3-S2's). However, for some routes and some terminal-to-terminal operations, some are configured as B-train doubles (28' + 27', 29' + 26') and some as Rocky Mountain doubles and double 45' in C-train configurations under special permit. At any given time, they have about 14 trains in the system, although all the 48' semitrailers are rigged to operate in double-trailer configurations. Freight density in part of the van operations is very light: the average payload of the 45' semitrailers is only 18,300 lbs.

Federated noted that the development of weight and dimension regulations in the Prairie provinces has favored the use of A-trains on its petroleum hauling. That is, because doubles were initially allowed only on primary highways (ie, in 1974 after the Western Highway Strengthening Program) and because Federated had an extensive retail network on the secondary road system, they had to select a configuration that could easily be configured as a 3-S2-S2 or a 3-S2 as the occasion demanded. Federated started with A-trains, but moved to B-trains because of the greater stability.

Safety with A-trains has been a problem. With recent (1982) changes in the regulations -- ie, extending the primary system and allowing the effective use of doubles on secondary highways -- Federated is phasing out its A-trains in favour of C-trains even though the A-train is more efficient in some cases (primarily because of its lower tare weight).

The continual adjustments in regulations presents a problem in trying to keep the fleet from becoming obsolete. These adjustments have forced the company to engage in a guessing game. In the past, when purchasing new equipment, they tried to size tanks so as to weigh-out on gasoline (gasoline is the least dense petroleum product). However, as the GVW limits were increased, they found that they were cubing out on gasoline -- resulting in a less than optimal fleet. In order to avoid this they now try to anticipate the changes and size the tanks for future regulations. This introduces two problems. First, the larger tank increases the tare

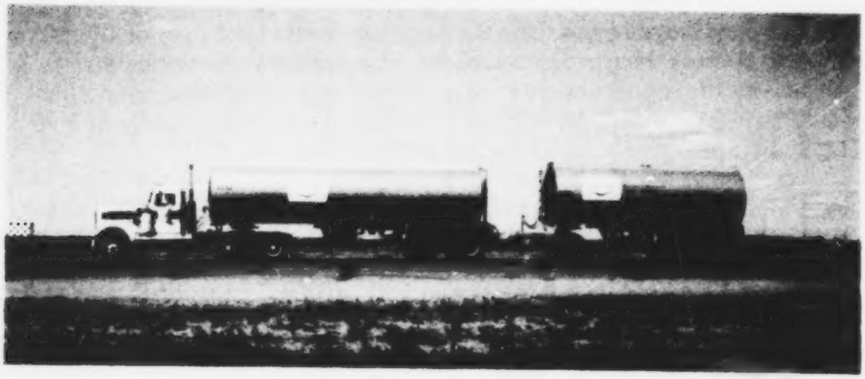


Figure 6.1.1 Federated Co-op: 3-S2-3

weight and therefore decreases payload under current regulations. If they have guessed the future regulations correctly, then this larger tank eventually pays for itself. The second problem, though, is when they guess incorrectly: they then incur the cost of larger tank, and the inefficiency associated with the increased tare. Federated is currently operating a number of 7-axle C-trains where the tank is sized so as to convert the pup to three axles (ie, convert a 3-S2-2 to a 3-S2-3) if and when the regulations change to make such a unit feasible. The conversion will be simply to add another axle to the existing pups.

Another situation which Federated faces is running into western Manitoba from the refinery in Regina. Manitoba permits 124,500 lbs. versus Saskatchewan 118,000 lbs. Federated, therefore, must run at lower weights -- the impact of which is to serve a smaller part of the Manitoba market out of Regina than might other be possible. They serve this market with 8-axle units -- the 118 kip GVW limit in Saskatchewan versus 124.5 kips in Manitoba results in about 4,200 lbs. difference in payload (ie, 6,500 lbs. difference in GVW less the weight of the additional axle of about 2,300 lbs.)

The company did purchase some 8-axle tanker units in anticipation of obtaining a permit to operate them in Saskatchewan. However, the permit has not materialized with the result that the company is now operating some sub-optimal equipment (there is no GVW advantage, in fact there is a payload penalty when 8-axle equipment is operated in Saskatchewan).

Federated believes there is a problem with the fact that regulations encourage A-trains when in their view it would be better to encourage B- and C-trains. In spite of the economic advantages of using A-trains, Federated is moving to B- and C-trains because of safety considerations.

Federated has taken full advantage of all changes in Western Canada as soon as possible after a change in the regulations; it has even tried to anticipate changes so as to avoid premature regulatory obsolescence. The company feels the most productive change in the regulations now would be to allow 8-axle B- or C-trains at about 137,000 lbs.

6.2 L.E. MATCHETT TRUCKING LTD.

L.E. Matchett Trucking of Saskatoon operates 93 tractors, all pulling A-train hopper-bottom trailers. The company hauls bulk commodities throughout Western Canada and 12 northwestern states. The A-train configuration is dictated by the following:

i. The company operates into the U.S. where (a) lower GVW's mean that anything larger than a 3-S2 is uneconomic or (b) where A-trains are required in those states permitting higher GVW's off the interstate because of the ability to lengthen the combination sufficiently to meet the bridge formula.

ii. Saskatchewan vigorously enforces the axle weight limits, and B-trains have a problem with overloading the centre tandem group. If this

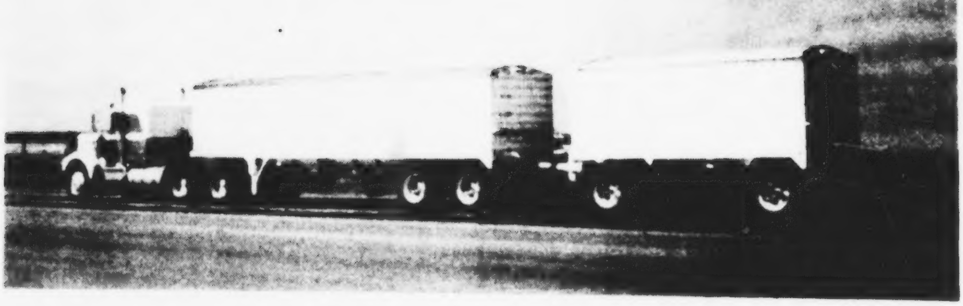


Figure 6.2.1 Saskatchewan: Hopper-Bottom (3-S2-2)

tandem is overloaded, drivers are required to unhook the semitrailers and shovel from one to the other. In Alberta, on the other hand, the enforcement of axle-load limits is not as severe and, as a consequence, there are fewer problems with B-trains.

iii. B-trains, because of the need to load asymmetrically, become unstable. Matchett Trucking believes that A-train hopper-bottoms are more stable than asymmetrically loaded B-train hopper-bottoms.

iv. The cost of A-trains and B-trains is about the same, whereas the payload on A-trains is higher (because of the lower tare weight). One manufacturer is now producing a "light weight" version of the A-train which further accentuates the difference (no "light weight" B-trains hopper-bottoms appear to have been built). The actual difference in payloads varies from one situation to another, but is generally in the range of 2,000 lbs.

Matchett management questions the rationale for not allowing A-trains to load to their axle maximums (ie, 120-121 kips rather than their current limit of 118 kips). They understood that the original idea for limiting A-trains to 118 kips had been to not give A-trains an inherent advantage over B-trains (ie, with a higher GVW). In doing so, they understood that the regulators were trying to encourage the use of B-trains. However, for all the reasons cited above, Matchett has had to select A-trains and, with axle loads at less than the maximum axle-load limits, they feel they are being forced to use configurations that are less efficient than they might otherwise be.

Matchett operates these A-trains with variable length tongues because of the U.S. regulations (B Formula). The tongue lengths varies from 3' to 16'. The company has also tried some spread tandems (66") to take advantage of increased loads allowed in some jurisdictions, however, they have found that tire wear is about 15% more on these than on the standard tandems (54"). Their current thinking on the subject is that the wide-spread tandems are probably not worth it in that the tire wear occurs for every mile driven while the benefits of larger loads only occurs for a part of their operations (primarily intra-B.C.).

The company also sees a problem with regulatory obsolescence in its fleet because of constantly changing regulations. They estimated that only 20% of the fleet is optimal at any one time. To the extent possible, they try to move the obsolete equipment into less intense operations, such a farm hauls, where utilization is low and therefore obsolescence is not so important.

Matchett has tended to implement all changes in regulations as soon as possible. They suggested that an 8-axle A-train at 137 kips would be an ideal unit for their operation. The company believes that past regulatory changes have lead to increases in productivity which, in turn, has increased truck-rail competition. It also believes the changes in VWD regulations have fostered intra-modal competition in the sense that some truck operators are being forced continually to try and/experiment with new configurations -- no trucking company can afford to stand still.

It is interesting to compare Matchett's view of A-trains versus B-trains on the issue of safety with the views of other operators. Matchett believes A-trains are safer, while companies such as Federated believe the opposite. It is clear that knowledgeable operators can have quite different opinions on this subject. The A-train/B-train/ C-train issue is not a simple one. The type of equipment (tank versus hopper-bottom), loading asymmetrically, the height of the centre of gravity and other factors are probably the important issues in understanding these different opinions.

6.3 ECONOMY CARRIERS LTD.

Economy Carriers provides common carrier and contract carrier services for pressurized liquids in tanks (propane, anhydrous ammonia etc.) petroleum, sulphur, etc. The operations are centered in Alberta but extend into adjacent jurisdictions -- particularly B.C.

The major regulatory problem faced by Economy Carriers concerns the 16.75 m kingpin-to-rear limit and its effect on tank operations (see the iscussion in Section 6.4). The non-uniformity of axle-load limits and GVW's throughout the West is also a problem for Economy.

Economy Carriers also has a problem with regulatory obsolescence of equipment -- that is, trying to keep a fleet optimal relative to the constantly changing regulatory framework in numerous jurisdictions.

6,4 ALTANK INDUSTRIES LTD.

Altank Industries Ltd. in Calgary manufacturers liquid, cryogenic, and compressed gas tanks and transportation vehicles. All the trailers they manufacture are custom designed.

The major regulatory problem they see currently is the 16.75 m kingpin-to-rear limit and the attitude of British Columbia to this aspect of the regulations. Whereas Alberta will give special permits where it is necessary to exceed this limit, B.C. will not.

The problem with the 16.75 m limit in the case of tank equipment has evolved as follows:

i. Propane and anhydrous tanks were traditionally designed with a standard 90" diameter. This was deemed to be the optimal balance between tank wall thickness dictated by hoop stress in the tank wall and other design parameters.

ii. When allowable GVW's and axle weights were increased, the cube of the tanks had to be increased to take advantage of the increased permitted loads. From a tank design point of view, manufacturers would like to have increased the length and kept the diameter at 90". However, because of the 16.75 m limit, they could not increase the length of the tanks sufficiently (with a 90" diameter) to take full advantage of the higher allowed loads.

iii. Given this constraint, their only choice was to increase the diameter of the tanks. There are two possibilities: either increased hoop stress thereby reducing the safety factor for a given wall thickness; or, an increased wall thickness to maintain the same safety factor, and an increase in the tare weight of the vehicle.

iv. Another important consideration is the fact that increasing the tank diameter also increases the height of the centre of gravity of the unit. Tank diameters had to be increased from 90" to 102" with the result that the centre of gravity was raised about 6". This in turn makes the vehicle more prone to roll.

v. Also, in designing tanks, it is important to be able to put the fifth wheel assembly under the head shell joint of the tank (the seam where the rounded front cap joins the tubular body of the tank). This is the strongest point and therefore the best place to transfer forces from the tractor to the trailer and vice versa. The 16.75 m limit forced designers to move the kingpin further back on the tank body, creating a potentially weak spot in the design.

There are numerous trade-offs in designing tanks. The strict interpretation of the 16.75 m limit has resulted in potentially inappropriate trade-offs. That is, it would seem more advisable to increase the length of a vehicle by 3-5' so as to maximize the strength of the tank in terms of hoop strength and so as to place the fifth wheel at the head shell joint as well as keeping the centre of gravity of the unit as low as possible.

In terms of the controversy about different types of train configurations, Altank designers view the B-train as the desireable vehicle primarily because it is more stable for the units they manufacture (with their high centers of gravity compared to hopper-bottoms or flatdeck). A-trains with short pups have a particular stability problem (ie, a tendency to roll).

The Altank designers do not believe that C-trains are the correct alternative. The C-train requires that the rear end of the lead trailer be "beefed-up" structurally to handle the (enormous) stresses developed when the vehicle turns short corners. This increased structural requirement for a C-train adds about 700 lbs. of steel to this configuration relative to an A- or B-train. Also it is not uncommon to have drivers forget to release the air on the steering mechanism on the C-train dolly prior to making a short turn. The result is to twist the dolly and over stress the rear of the lead trailer. There is also a problem with the C-train dollies in terms of maintenance requirements. They require an inordinate amount of maintenance and if not properly maintained can be unsafe.

6.5 PORTER TRUCKING LTD.

Porter operates a fleet of vans, mostly refrigerated, throughout Western Canada (Winnipeg to Vancouver) with the majority of the activity in Alberta and British Columbia. In Porter's words, they have at least one of most possible length /configurations available. This creates some problems in putting units together in acceptable combinations.

Some years ago, Porter operated 3-S2 equipment exclusively, but more recently they have been moving to trains (A, B, and C) to take advantage of both the higher cube and weight possibilities. Cube is usually the problem with LTL traffic while weigh-out problems usually involve TL traffic. Porter's major problem is cube.

In the past, the company had 42 B-trains with 29' lead and 26.5' rear semitrailers. These units all observed the 23 m overall length limit but were 6" over on the 16.75 m kingpin-to-rear limit. Initially, this did not create a problem because no one bothered to measure them. At some point, a B.C. official measured one of these B-trains and laid a charge. Once B.C. officials realized that the units were too long on the kingpin-to-rear, they began measuring them all. Porter approached B.C. officials requesting a special permit for these overlength units, but they would not consider it. In the end Porter had to cut 6" out of the 42 rear trailers, at a cost of about $50,000. It was impossible to shorten the hitch between the units because of clearance requirements on turns. Removing the 6" from the length of the rear trailers did not create any serious problem (ie, reducing the number of pallets that could be handled); it simply reduced the overall cube available for hand-loaded loose freight.

Porter has experienced some frustration with respect to the different allowable GVW and axle weights across the West. They have to restrict their operations to the lowest common denominator which has a negative impact on productivity. The company's preferred set of regulations are those in B.C. (these are the highest axle and GVW limits in their area), and their preferred configuration is the 7-axle B-train with a slidable tandem on the lead unit (ie, a tandem that slides forward underneath the first semitrailer to facilitate loading and unloading). Another configuration that Porter favors is the 8-axle A-train (3-S2-3) with a lead unit capable of handling 45,000-50,000 lbs. and the second unit capable of handling 25,000-30,000 lbs. Experience has indicated that this is a stable and operationally efficient unit. The 8-axle B-train (triple in the middle) presents a problem in turning short radius corners in urban areas.

In moving to higher axle loads and GVW's, Porter favors a uniform 140,000 lbs. for GVW and a permitting system for special operations above this mass. This would provide regulators with the control they require and the industry with more flexibility. Individual operators, if necessary, could custom configure their units for their operations subject to approval by the regulators.

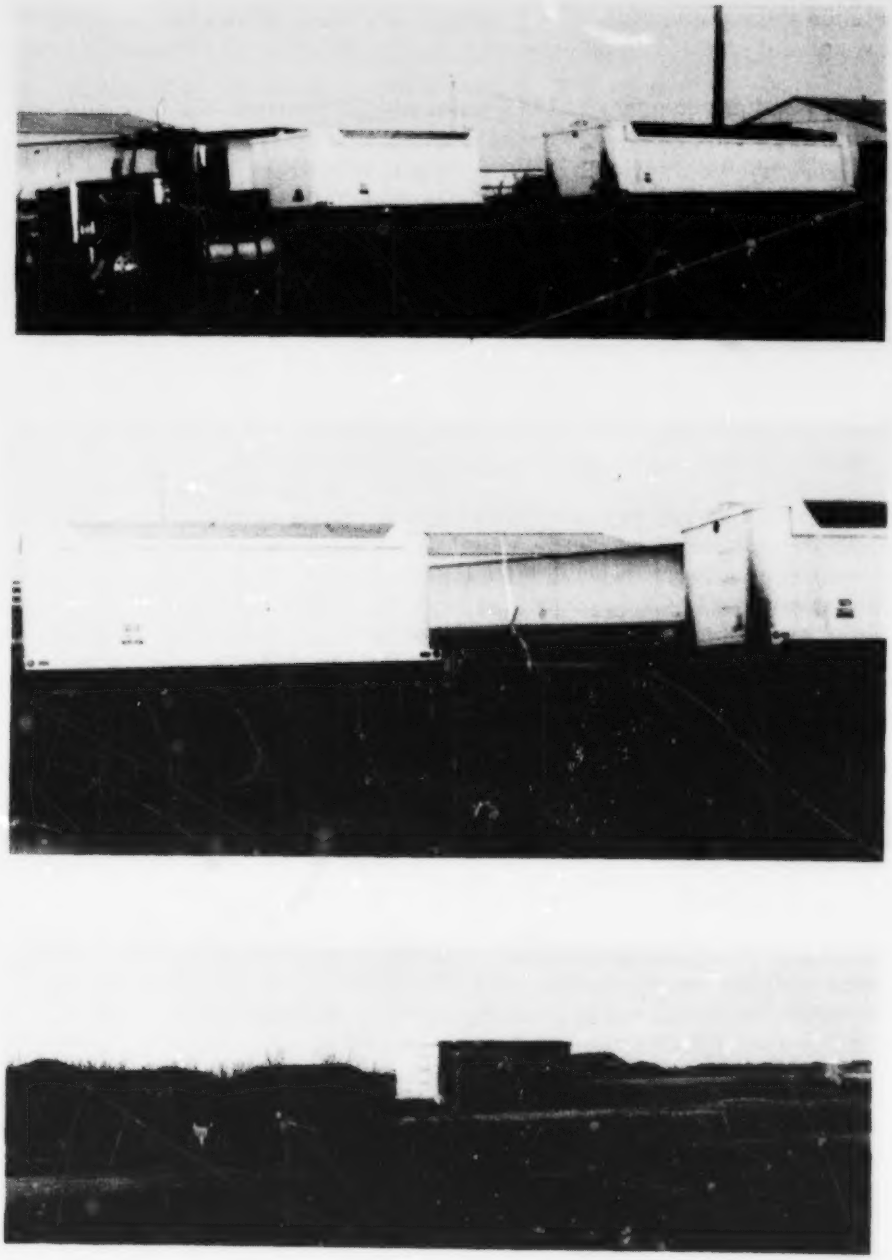


Figure 6.6.1 Saskatchewan Gravel Truck

7. Case Studies: Bristish Columbia

7.1 BULK SYSTEMS

Bulk Systems (a division of CP Trucks) operates a variety of combinations across Canada. For here, the attention is limited to three types based in British Columbia: (a) 7-axle B-trains used for wood chip hauling, (b) 6-axle tractor-semitrailer and 8-axle B-train tankers used to haul petroleum products, and (c) 8-axle A-train dump equipment used to haul ores.

7.1.1 Wood Chip Hauling

Bulk Systems in B.C. has 15 trailers used in B-train combinations for its wood chip hauling operations. The 3-S2-S2 combinations, with a capacity of 5,600-5,800 cubic feet of wood chips, are as shown in the top of Figure 7.1.1. These trains are unloaded on a tilt table, the two semitrailers constructed such that the lead unloads through the rear.

The reasons offered for choosing this type of combination were: B-trains, unlike A-trains, can be backed; and, B-trains track straighter than A-trains. Offsetting these advantages, B-trains have a higher tare weight. In fact, it was noted that there is a general move by the trucking industry back to A-trains because of this tare weight consideration.

7.1.2 Tank Operations

Three types of configurations are used to haul petroleum products; conventional 5-axle tractor-semitrailers (3-S2's); 8-axle B-trains with a capacity of 60,000 litres with spreads and spacings similar to other B.C. 8-axle B-trains (see Section 7.2); and 6-axle tractor-semitrailers with a capacity of 47,000 litre, as shown in the middle of Figure 7.1.1. In total, Bulk Systems has 136 tank trailers used in these configurations.

The axle-spacings and spreads shown for the 3-S3 have been estimated such that the optimal load could be carried: the tandems have a spread of 60" (allowing 17,000 kg), and the spacing between axle #4 and #6 is 209" thereby allowing a combined load of 27,000 kg on the last three axles (load shown is 26,100 as the single axle cannot carry more than 9,100 kg). Given these specifications, and a front axle load of 6,000 kg, the vehicle would be legal at 49,100 kg, and would have the following approximate weights:

• payload	33,763 kg	(10,340 gallons X 7.2)
• tare	15,337 kg	
• GVW	49,100 kg	

The B-train tanker (not shown) is used where shipments are in large enough quantities and where the delivery point allows its use -- sometimes at retail gasoline stations the B-train is more manoeuverable than the 3-S3. The tractor-semitrailer is used on some hauls (eg, mountainous) where it can operate faster than the B-train.

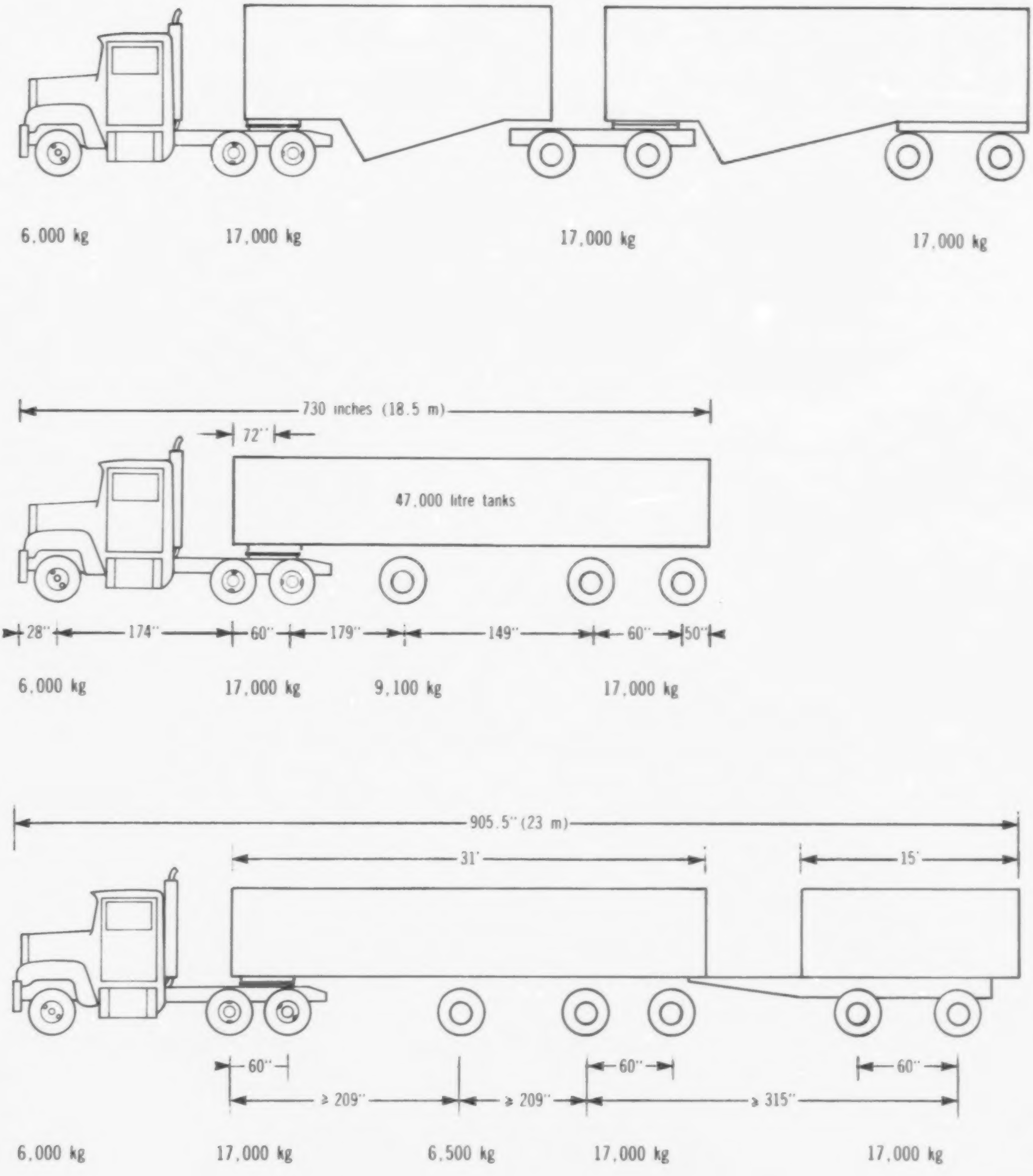

6,000 kg
17,000 kg
17,000 kg
17,000 kg
730 inches (18.5 m)
72"
47,000 litre tanks
28"
174"
60"
179"
149"
60"
50"
6,000 kg
17,000 kg
9,100 kg
17,000 kg
905.5" (23 m)
31'
15'
60"
≥ 209"
≥ 209"
60"
≥ 315"
60"
6,000 kg
17,000 kg
6,500 kg
17,000 kg
17,000 kg

Figure 7.1.1 Bulk Systems: Configurations

7.1.3 Ore Hauls

Bulk systems has 14 trailers made up into seven A-train sets for hauling ore, as shown in the bottom of Figure 7.1.1. The pup trailer is a "pony" because of the dump mechanism -- that is, two single axles (instead of the tandem shown) would interfere with the dumping action of the box. Also on both the lead semitrailer and on the pony trailer, the tail gate is a two-way mechanism -- that is, swinging either up to allow dumping, or down to form a ramp and thereby allowing fork lifts to load the trailers with zinc and/or other backhaul commodities.

No measurements were made or obtained on the positioning of axles for these A-trains; the sketch in Figure 7.1.1 is an approximation, with the minimum axle spacing requirements shown for the maximum axle loads. For example, there has to be a minimum of 315" between axle #5 and #7 to allow 34,000 kg on the two tandems.

7.2 JOHNSTON TERMINALS LIMITED

Johnston Terminals is one of the larger for-hire trucking companies in British Columbia, operating under a number of different names (Public Freightways Ltd, Rempel-Trail Transportation Ltd., Johnston Moving and Storage Ltd., and others). The combination types discussed with the company were: (a) A-trains used in their general freight business (LTL and TL); (b) tank trucks; and (c) container hauling B-trains.

7.2.1 General Freight

The typical configuration used by Johnston Terminals in its general freight operation is a 6-axle A-train (3-S1-2) as shown in Figure 7.2.1. The combination is registered at 110 kips (49,800 kg), although this much weight is not generally needed for LTL business. The company registers at these weights in order to back-haul TL freight.

The sketch shown in Figure 7.2.1 is based on an old drawing that may be dated. In particular, the configuration as shown has a 4" positive fifth wheel offset. These are not legal in British Columbia on 3-vehicle combinations registered at 57,000 kg or more. Although Johnston Terminals combination is only registered at 49,800 kg (ie, the postive offset is legal), the company says that it no longer has any 3-vehicle combinations with postive offsets. The sketch in Figure 7.2.1, it is believed, would be more accurate with a shorter drawbar -- something in the order of 36" making the distance between axles #4-#5 96" instead of the 103" shown.

There are several points to note about why Johnston Terminals prefers this type of configuration. With 54 feet of trailer space, this configuration gives about as much cube as is possible under British Columbia's regulations. Although double 28' combinations are possible -- with large kingpin setbacks -- the effective trailer space is the same as double 27's if the double 28' pups have to be configured with tapered noses ("bull noses"). Also, while some carriers argue that the new 48' semitrailers give almost as much useful space as double 27's (given that a couple of feet of space is "lost" in each trailer with some types of freight), there is a disadvantage in switch-

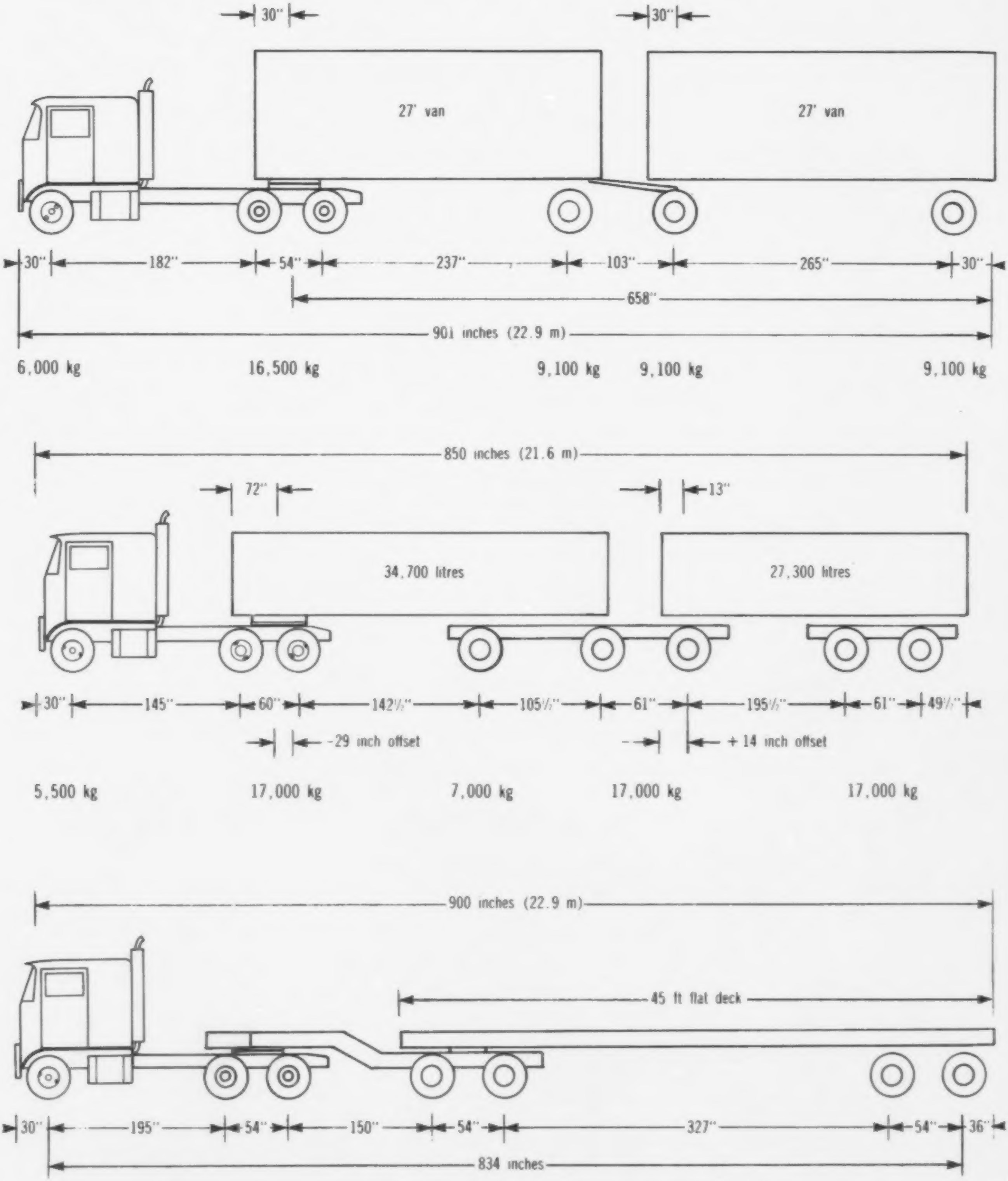

30"
30"
27' van
27' van
30"
182"
54"
237"
103"
265"
30"
658"
901 inches (22.9 m)
6,000 kg
16,500 kg
9,100 kg
9,100 kg
9,100 kg
850 inches (21.6 m)
72"
13"
34,700 litres
27,300 litres
30"
145"
60"
142½"
105½"
61"
195½"
61"
49½"
-29 inch offset
+ 14 inch offset
5,500 kg
17,000 kg
7,000 kg
17,000 kg
17,000 kg
900 inches (22.9 m)
45 ft flat deck
30"
195"
54"
150"
54"
327"
54"
36"
834 inches

Figure 7.2.1 Johnston Terminals: Configurations

V W D

ing to 48' semitrailers in British Columbia. Specifically, with 48' semitrailers only allowed tandem-axle loads (unlike 45' semitrailers) the GVW of a 3-S2 is held to a maximum of 40,000 kg with a 6,000 kg front axle (and theoretically 43,100 kg if the front axle is loaded to the maximum) versus a maximum GVW of the 3-S1-2 of 49,800 kg (front axles on these combinations are only permitted 6,000 kg).

Several other points to note are:

i. These doubles give the company flexibility -- primarily in respect of its LTL business where 27' pups are well suited for the splitting and re-combination that goes on in a large multi-terminal operation. Johnston terminals (its Public Freightways division) is currently in the process of re-organizing a major portion of its operation where the use of double 27' pups is central to the new process. Using the Vancouver area as the hub, the company is dispatching doubles from there to various destinations in the province and using the 27' pups directly for the deliveries to consignees. This is replacing a system of dispatching loads of LTL freight from the Vancouver area out to small terminals where the freight was re-loaded on to local delivery vehicles.

ii. The company would prefer to run double 28' pups (at current axle/GVW load limits) as this would give more cube for LTL freight and as the 28' semitrailer is becoming the North American standard. Although the kingpin-to-rear limit of 16.75 m makes it difficult and/or impractical to operate double 28's, the company has plans for the gradual introduction of such configurations.

iii. These 27' (or ideally 28') semitrailers are well suited for the operation of longer-combination-vehicles on the new highway to Merrit -- in either triple or Rocky Mountain double configurations (*the industry is currently lobbying the government for special permit operations of this sort*).

7.2.2 Tank Trucks

The 8-axle B-train used by Johnston Terminals for hauling petroleum products is similar (if not identical) to those used by other petroleum haulers. The one shown in Figure 7.2.1 is based on drawings provided by Columbia Remtec (the manufacturer).

Given British Columbia's regulations -- and in particular the axle spacing requirements and axle-self-steer requirements -- all 8-axle B-trains are roughly similar. The main variables are the over-all length which is primarily a function of tractor wheelbase and the length of the trailers needed for the freight density being hauled, and the positioning of axle #4. In some cases, this extra axle (ie, not part of a tandem group) is placed on the second semitrailer; that is, a 3-S2-S3 instead of the 3-S3-S2 shown in Figure 7.2.1 (see for example Figure 7.6.2). The extra axle is always self-steering (see the regulations) and usually has an air-lift mechanism for backing purposes and/or empty truck movements.

On the configuration shown, the spacing from axle #2-#4 is 202.5" allowing a total weight on the three axles of 26,000 kg (the actual weight shown is 24,000 kg).

The second critical spacing, axle #4-#6, is 166.5" allowing a combined load of 24,000 kg -- which is what the vehicle has been configured for.

With 62,000 litre tanks (six tanks), the vehicle can haul 58,100 litres of gasoline or 50,000 litres of diesel, with a payload of 42,975 kg. The tare weight of the combination is 20,525 kg (9,072 for the tractor, 6,940 for the lead semitrailer, and 4,513 for the rear semitrailer) for a total GVW of 63,500 kg.

7.2.3 Container Trailers

The 7-axle container trailer -- referred to as a B-train by some people in B.C. -- shown in Figure 7.2.1 is fairly unique (a picture of a comparable configuration is shown in Figure 7.6.3). Johnston Terminals was the first company to use such a design, although now there are others doing so with, it is believed, some improvements on some aspects of this configuration (discussed in Section 7.4). The unit has been designed to operate in Washington and British Columbia in order to haul heavy (60,000 lb. plus) containers.

In terms of British Columbia's regulations, points to note about its design are: (a) the two articulation points qualify this vehicle for an over-all length of 23 m (actual length is 75 feet); (b) the 54" tandems (three of them) are allowed loadings of 16,500 kg each; (c) the axle spacing between #2 and #5 of 258" allows a combined loading on the two tandems of 30,000 kg (66,139 lbs.).

The interesting point about this configuration is that it is possible to carry the same payload (60 kips) on a 3-S3 under B.C.'s regulations. That is, a 3-axle tractor and a 3-axle semitrailer (45') can have a maximum GVW of 52,200 kg, although given the difficulty of loading front axles to 9,100 kg, 49,000-50,000 kg is more realistic. With a tare weight of about 17,000 to 18,000 kg, such a unit could have a payload of 31,000 to 33,000 kg (roughly 68,000 to 72,600 lbs.) So, if it were just the British Columbia influencing fleet configurations, heavy containers would not be hauled in a design as shown in Figure 7.2.1.

The "problem" is in the state of Washington where a RGVW of 101,000 lbs. (45,800 kg) requires a distance of at least 69'6" between the first and last axles (Bridge Formula B) and where allowed axle loads are lower than in B.C. (34,000 lbs. on a tandem). The conflicts in designing a combination to meet both sets of regulations are: (a) the greater axle spacing in Washington (69'6") means that the 20 m length limit in B.C. for combinations with one articulation point cannot be met -- the solution being to design a combination with two articulation points but still with at least 40 feet of deck length ;* (b) the B.C. requirements on axle spacing and self-steering axles which make it difficult (not impossible) to use three axles on one of the vehicles; and (c) the Washington regulation that limits GVW to 80,000 lbs. except for those annual permits for "twin trailer, truck-trailer and 'B' train combinations not exceeding 75' in length or 105,000 lbs. gross weight (within Formula B limits)."

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* *It is understood that to exceed 80,000 lbs. in Washington, the combination also has to have two articulations points.*

The configuration shown in Figure 7.2.1 gets around these problems and allows containers weighing in excess of 60,000 lbs. to be hauled in both jurisdictions. It appears, though, that the "price" of using such a vehicle is a high tare weight to payload ratio -- something in the order of 40,000:60,0000 lbs.

7.2.4 Other Points

Several other points were raised in discussions with Johnston Terminals:

i. Johnston Terminals does not feel the extra tare weight of a B-train, in comparison to an A-train, is a disadvantage. It was noted that a B-train actually has an advantage (aside form any consideration of backing or stability) in that the rear pup can load higher than the rear pup in an A-train. That is, a pup in a 3-S1-2 or 3-S2-2 configuration can have a maximum GVW of 18,200 kg (ie, two single axles at 9,100 kg each). In a B-train, on the other hand, a part of the rear pup's load is carried by the tandem axle on the lead. So, for example, the pup shown in the middle of Figure 7.2.1 has a total GVW of 24,275 kg (ie, 6,075 kg higher than the maximum GVW possible in an A-train).

i. Johnston Terminals would probably reduce the number of doubles it operates (except in its LTL operations) if it were possible to get higher GVW's in tractor-semitrailer configurations (as in some other provinces). Excluding the use of such things as jeeps (as shown in the bottom of Figure 7.2.1), B.C. regulations currently allow roughly the following (assuming 6,000 kg front axles):

3-S3 - 45' of trailer and 49,100 kg of GVW
3-S2 - 48' of trailer and 40,000 kg of GVW
A- or B-train - 54'-56' of trailer and 63,500 kg of GVW

iii. As with other B.C. carriers, Johnston Terminals thinks there are problems with the available power units when operating at 63,500 kg. Apparently the more-or-less standard 400 hp, 15-speed transmission power plant is not being built rugged enough to take the pounding that occurs at 63,500 kg in a mountainous region.

7.3 COLUMBIA REMTEC INC.

Columbia Remtec is a trailer manufacturer located in Burnaby. In addition to providing details on configurations operated by other carriers interviewed, information on wood chip hauling as well as various other matters was obtained.

7.3.1 Wood Chip Trucks

The newest design in trucks used for wood chip hauling, a truck-plus-trailer, is shown in Figure 7.3.1 along with an 8-axle B-train chip hauler. (Axle spacings for the truck-plus-trailer are shown in both inches and centimeters.) Points to note about the truck-plus-trailer are: (a) the 315 mm tires on the tandem-steer axle (allowing as much as 13,860 kg); (b) the drawbar which collapses to allow the truck-trailer bodies to draw together during unloading operations; and (c) a series of mechanisms (not shown) that open to make the two bodies one unit during unload operations on a longitudinal tilt table.

The following figures compare some aspects of this unit with the more common 8-axle B-train (some of these figures have been estimated):

	8-axle Truck-plus-Trailer	**8-axle B-train**
GVW (kg)	63,500	63,000 to 63,500
Tare (kg)	20,319	21,713 to 23,636
Payload (kg)	43,181	39,864 to 41,287
(cubic ft.)	6,066	5,600 to 5,800
Cost (1986)	$250,000	$225,000 (approx.)

Although precise information is lacking, it is understood that the truck-plus-trailer is not as easy to handle as the B-train: it has a somewhat larger turning circle (60' or so), it is a bit more difficult to back, and it "feels" less stable than the B-train on the road. The main reason for the higher cost of the truck-plus-trailer is the tandem-steer front axles, the second axle in this tandem being an air lift.

7.3.2 Other Points

Other points discussed with Columbia Remtec include:

i. At some time in the past, a few B-train tankers with drome tanks on the tractor were built in British Columbia -- as shown in Figure 7.3.2. In terms of the axle loads shown, these are based on regulations that are now out of date (note the high tandem loads). Although precise details from the available regulations are vague, it is understood that this type of configuration is now not permitted in B.C. There is some confusion (among industry sources) over this point -- all that has been determined to date is that while drome boxes (or tanks) themselves are not illegal, there is something about their use in a train configuration that is either not within some aspect of the regulations or perhaps just "discouraged" by Victoria. The few that were built and are still operating have grandfather rights. In any case, whether they are legal or not, Columbia Remtec noted that there are some operational problems with them (at least the one shown in Figure 7.3.2). Apparently, with the drome tank empty, there is a problem with axle-weight distribution.

ii. The "2.25 m rule," stipulates that no part of a trailer or its load may extend more than 2.25 m (88") in front of the kingpin (or point of articulation). The effect of this is that with 102" wide trailers, the largest kingpin setback possible is about 72". It is not known how long this part of the regulations has been in effect (note, for example, that the kingpin setback on the B-train in Figure 7.3.1 is shown greater than 72").

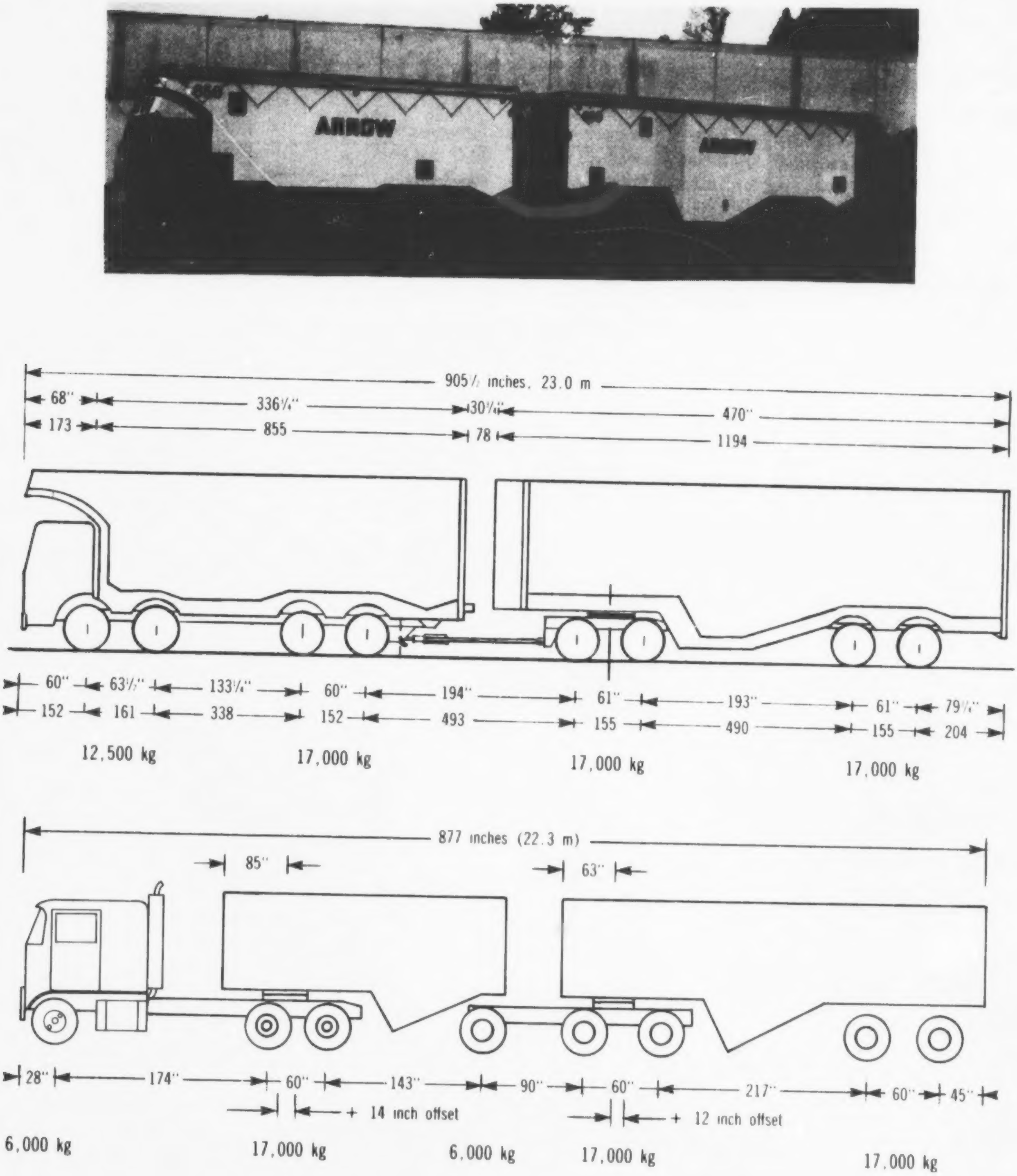
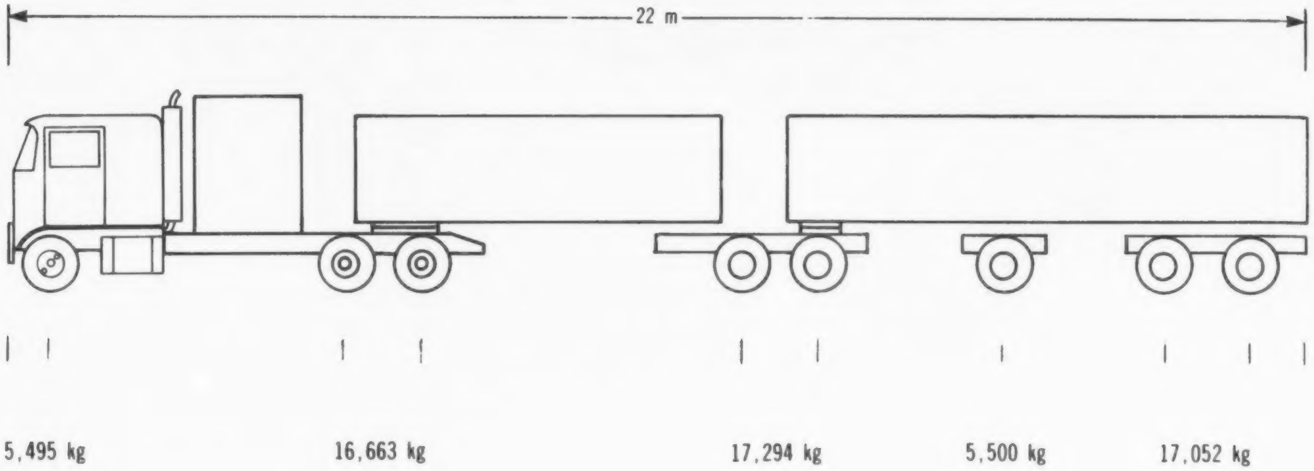
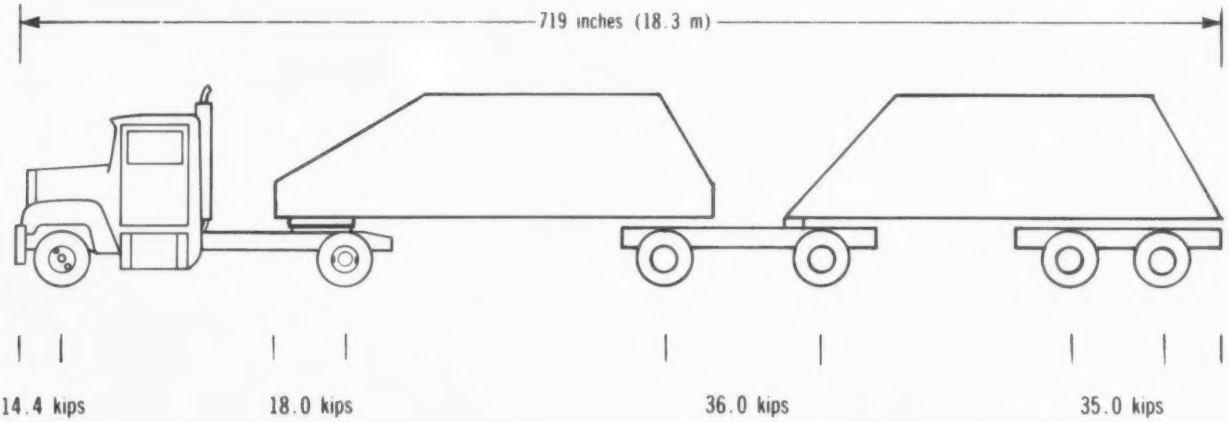

850
ARROW
ARROW
905½ inches, 23.0 m
68"
336¼"
30¼"
470"
173
855
78
1194
60"
63½"
133¼"
60"
194"
61"
193"
61"
79¼"
152
161
338
152
493
155
490
155
204
12,500 kg
17,000 kg
17,000 kg
17,000 kg
877 inches (22.3 m)
85"
63"
28"
174"
60"
143"
90"
60"
217"
60"
45"
+ 14 inch offset
+ 12 inch offset
6,000 kg
17,000 kg
6,000 kg
17,000 kg
17,000 kg

Figure 7.3.1 Columbia Remtec Inc: Wood-Chip Haulers


22 m
5,495 kg
16,663 kg
17,294 kg
5,500 kg
17,052 kg

8-axle B-train Tank Truck with Drome


719 inches (18.3 m)
14.4 kips
18.0 kips
36.0 kips
35.0 kips

The first B-train (1972)

Figure 7.3.2 Columbia Remtec Inc: B-trains

(Tapered-nosed trailers would be able to use somewhat larger kingpin setbacks.)

iii. Finally, Columbia Remtec (or "Columbia Trailer Company Ltd." as it was in the early 1970s) has some claims for the development of the first B-train in Canada. It is understood that there are disputes about these claims for the development of the B-train. In any case, to substantiate their own, the sketch in the bottom of Figure 7.3.2 is based on drawings from Columbia Remtec dated 1972. The vehicle shown, which Columbia Remtec says was built, is referred to in these early drawings as a "double semi trailer train." It was designed to haul concentrate for Arrow Transfer Co. Lornex Haul.

7.4 INTERMOUNTAIN TRANSPORT CO. LTD.

Intermountain (Intermountain Transport Co. Ltd. and Commercial Truck Co. Ltd.) based in Coquitlam operates a variety of equipment in British Columbia and neighbouring states and provinces. Two types are considered here.

7.4.1 Containers

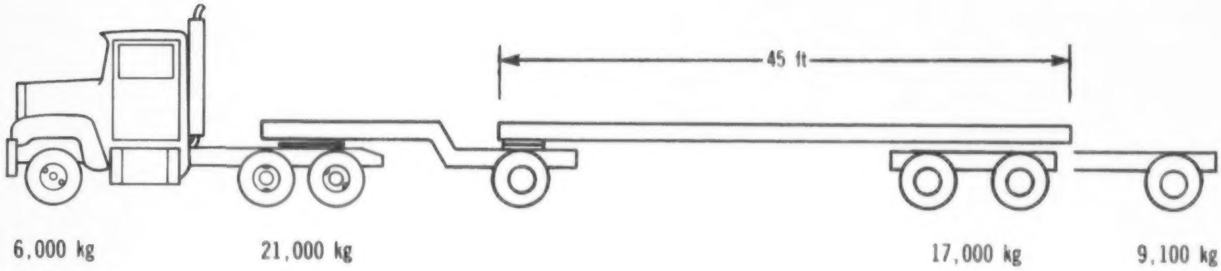
The heaviest containers (up to 65,000 lbs.) are hauled on the configuration shown in Figure 7.4.1. Intermountain has two of these units, which were built by L. Knight Trailers. Points to note are:

i. This unit is a double in the sense that there are two articulation points. As such the 23 m length limit applies.

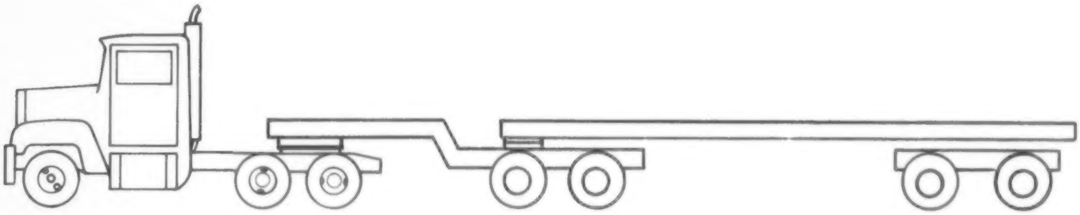
ii. Intermountain says that there is a weight distribution problem with the alternative 7-axle configuration (shown as an insert in Figure 7.4.1). Specifically, the drive axles are too light.

iii. The unit shown has been configured to comply with the weight and dimension regulations in both B.C. and Washington (it is used on the Seattle-Vancouver lane). In particular (the precise specifications were not obtained) the distance from the first to last axle is probably in the order of 834" or so in order to meet the requirements of Washington's Bridge Formula B -- allowing a GVW of just over 100,000 lbs. The axle loads shown in Figure 7.4.1 are estimates of the probable legal limits in B.C. (with some assumptions about the spacing between axles #3-#4).

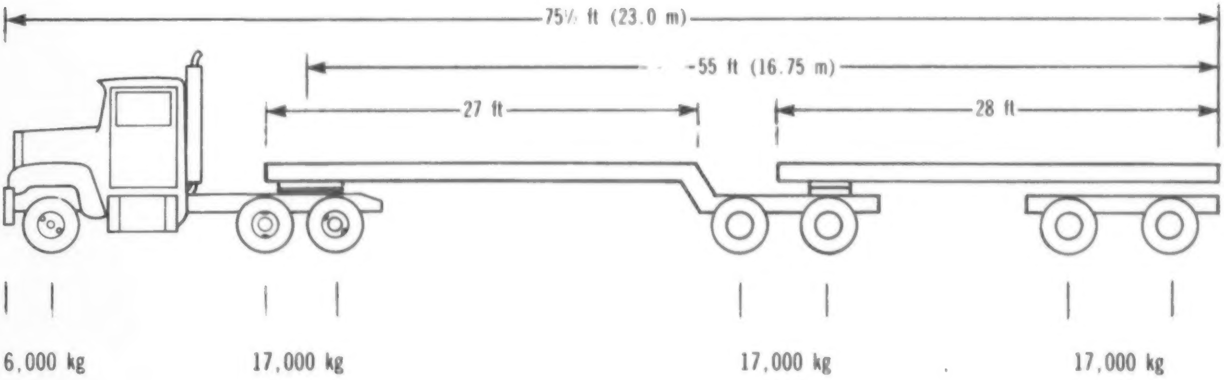
An interesting point concerning 20' containers is that under B.C.'s regulations, it is not possible to haul these on 20' container chassis or 20' flatdecks. For example, if the industry used a 20' chassis to carry the containers (as is done in some provinces), the weight (up to 50,000 lbs.) is too high. Without the precise figures, a conventional 5-axle tractor semitrailer, with a 20' container chassis or flatbed, would have to have more spacing between axles #2-#5 (ie, the outer spacing of the two tandems) to register at the required 76,000 lbs. (50,000 lb. payload and 26,000 lb. tare).


45 ft
6,000 kg
21,000 kg
17,000 kg
9,100 kg

Heavy-Container Trailer



Alternative


75½ ft (23.0 m)
55 ft (16.75 m)
27 ft
28 ft
6,000 kg
17,000 kg
17,000 kg
17,000 kg

"Super Light" B-train Flat Deck

Figure 7.4.1 Intermountain Transport Co. Ltd: Configurations

7.4.2 Flatdecks

Intermountain operates a variety of flatdeck configurations. The one shown in Figure 7.4.1 is their "super light" B-train. The GVW shown, 57,000 kg, is optimal in terms of the highest axle loadings possible (given 60" tandems). With a tare weight of only 37,500 lbs. (17,010 kg) there is a theoretical payload capacity of just over 88,000 lbs. (almost 40,000 kg). However, given freight characteristics and axle loading characteristics, these flatdecks probably only achieve payloads more in the range of 80,000-85,000 lbs.

Some segments of the industry are moving back to A-trains because of the payload advantage. While precise figures on the tare weight of a comparable 7-axle A-train (3-S2-2) were not obtained, it was estimated that the difference between an A- and a B-train flatdeck was probably in the range of 4,000 lbs.

7.5 L. KNIGHT & CO.

. Knight & Co. Ltd. is a trailer manufacturer located in Langely. Three types of trucks were discussed: container trailers, lowbeds, and dump or gravel trucks. In addition, a few points of general interest were raised.

7.5.1 Container Trailers

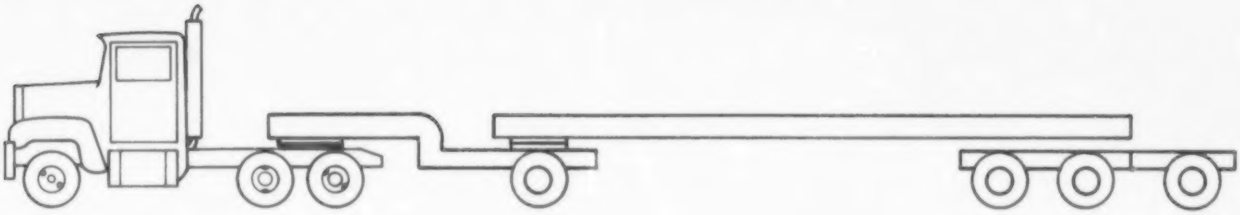
L. Knight built the container trailers described in Section 7.2 (Johnston Terminals) and in Section 7.4 (Intermountain). The second of these is shown at the top of Figure 7.5.1. While details on axle spacings and axle loads are imprecise, it is estimated that the axle loads are probably as follows: 6,000 kg on the steering axle, 21,000 kg on the next three axles (tandem drives and jeep), 17,000 kg on the semi-trailer tandems, and 9,100 kg on the extension. With a total GVW of 53,100 kg, the vehicle can haul 40' containers weighing up to 68,200 lbs. The unit has been configured to comply with both B.C. and Washington regulations (*see the description in Section 7.4*).

7.5.2 Lowbeds

The company builds a variety of lowbeds, as shown in the middle of Figure 7.5.1. Assuming a front-axle load of 5,500 kg, the maximum GVW's of the first two of these configurations would be 39,500 kg and 44,000 kg. The extra axle in the second configuration, called a "load shifter" is self-steering. The last configuration shown (with a jeep and an extender) has a GVW of 51,500 kg. While information on tare weights is not known, it is understood that the tare weight of the third unit is high: the jeep and the extender are relatively heavy, so the increase in possible payload is nowhere near the figures suggested by the differences in GVW (ie, 52,500 versus 44,000).

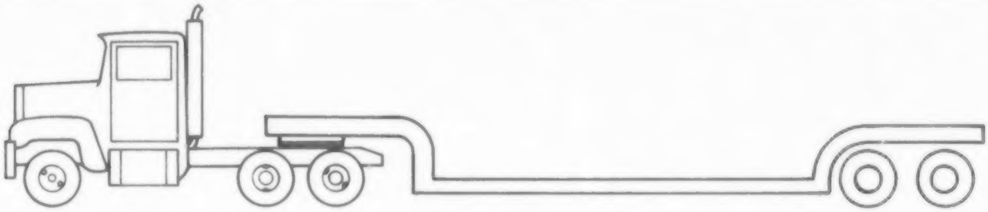
7.5.3 Gravel Trucks

The dump truck shown in the bottom of Figure 7.5.1 is a rough sketch -- no actual details on axle spacing are known. Pictures of some of these configurations are shown in Figures 7.5.2 and 7.5.3 -- a 3-2, a 3-3 and a 3-2 (pony). The interesting

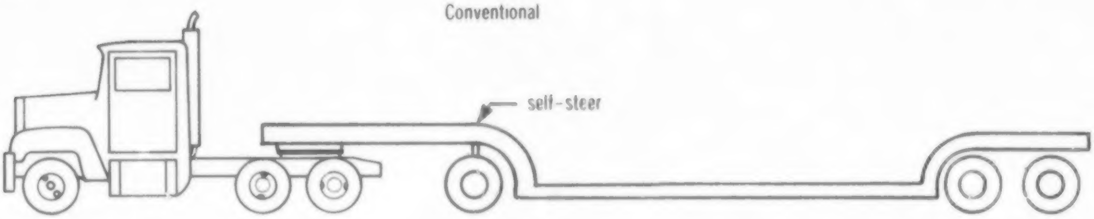


Heavy Container Hauler

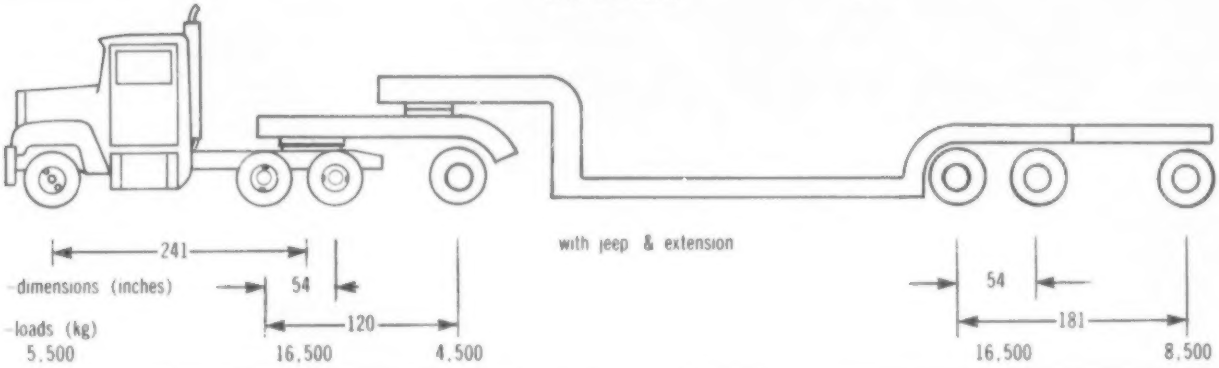
Low Beds



Conventional



with load shifter


241
-dimensions (inches)
54
120
-loads (kg)
5,500
16,500
4,500
54
181
16,500
8,500

with jeep & extension

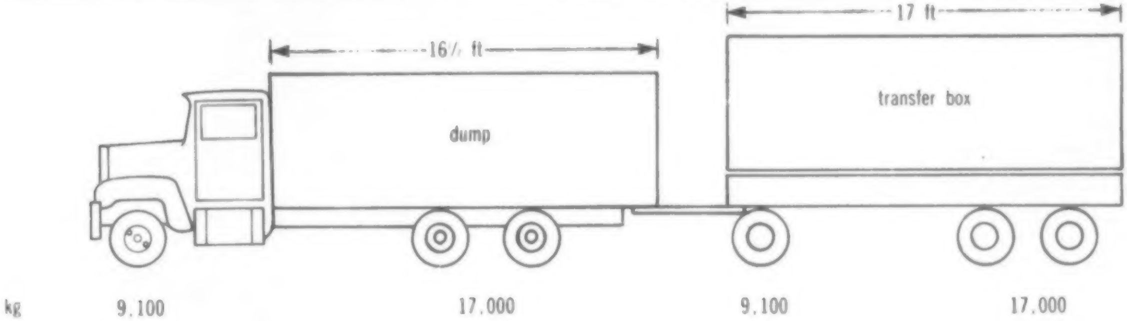

16½ ft
17 ft
dump
transfer box
kg
9,100
17,000
9,100
17,000

Figure 7.5.1 L. Knight & Co.: Flatdecks, Lowbeds, & Gravel Trucks

point to note about some of these vehciles is that the box on the trailer is dumped by the truck. That is, after dumping its own load, the truck pulls the transfer box up onto its own box and dumps the trailer load. Apparently, the advantages of this type of arrangement are the versatility on unloading points (where often only a straight truck can manoeuver into the site), the ease of dumping (because of the shortness of the box, it is more stable than a trailer), and possibly a somewhat lower tare weight and capital cost in that the trailer has no hydraulics (this last point is speculative). The 3-2 shown in Figure 7.5.2 has such a transfer box; the two shown in Figure 7.5.3 may have their own hydraulics.

7.5.4 Other Points

Other points of interest discussed with L. Knight & Co. include the following:

i. Front-axle setbacks never exceed 48" in British Columbia. By way of comparison, front-axle setbacks of at least 60 inches are relatively common in Ontario. The reason for this (ie, 48" maximum in British Columbia) was not known.

ii. Although there are 4-axle trucks in British Columbia, they are limited to the tandem-steer variety. In other words, there are no single-steer plus air-lift plus tandem-axle straight trucks. The reason for this is that the extra axle (the air lift) would have to be a self-steering axle and apparently this is not allowed in a vehicle used to tow another vehicle.

7.6 OTHER B.C. CONFIGURATIONS

Several interesting configurations were observed at weigh scales in British Columbia. The first two shown in Figure 7.6.1 are of interest because of their use of single tires on some of the axles. The second unit shown (Dairyland) is a 9-axle A-train arranged as follows:

o	o o	o o	o o	o o
single	dual	single	single	single

With 11 inch tires, these tandem axles would be allowed 12,294 kg (ie, 4 tires X 11" X 25.4 X 11 kg/mm) and with 12" tires they would be allowed 13,411 kg. The Dairyland configuration was observed with about 12,800 kg on each of the single-tire tandem axles.

In Figure 7.6.2, two 8-axle B-trains are shown. Unlike those described for Johnston Terminals, these both have the extra steering axle on the rear semitrailer.

In Figure 7.6.3, the rather unique 7-axle "B-train" or "tractor-jeep-semitrailer" (described in Section 7.2) is shown -- this one is carrying steel rods rather than a container.

Two truck-plus-trailers are shown in Figure 7.6.4, and two tank trucks are shown in Figure 7.6.5.

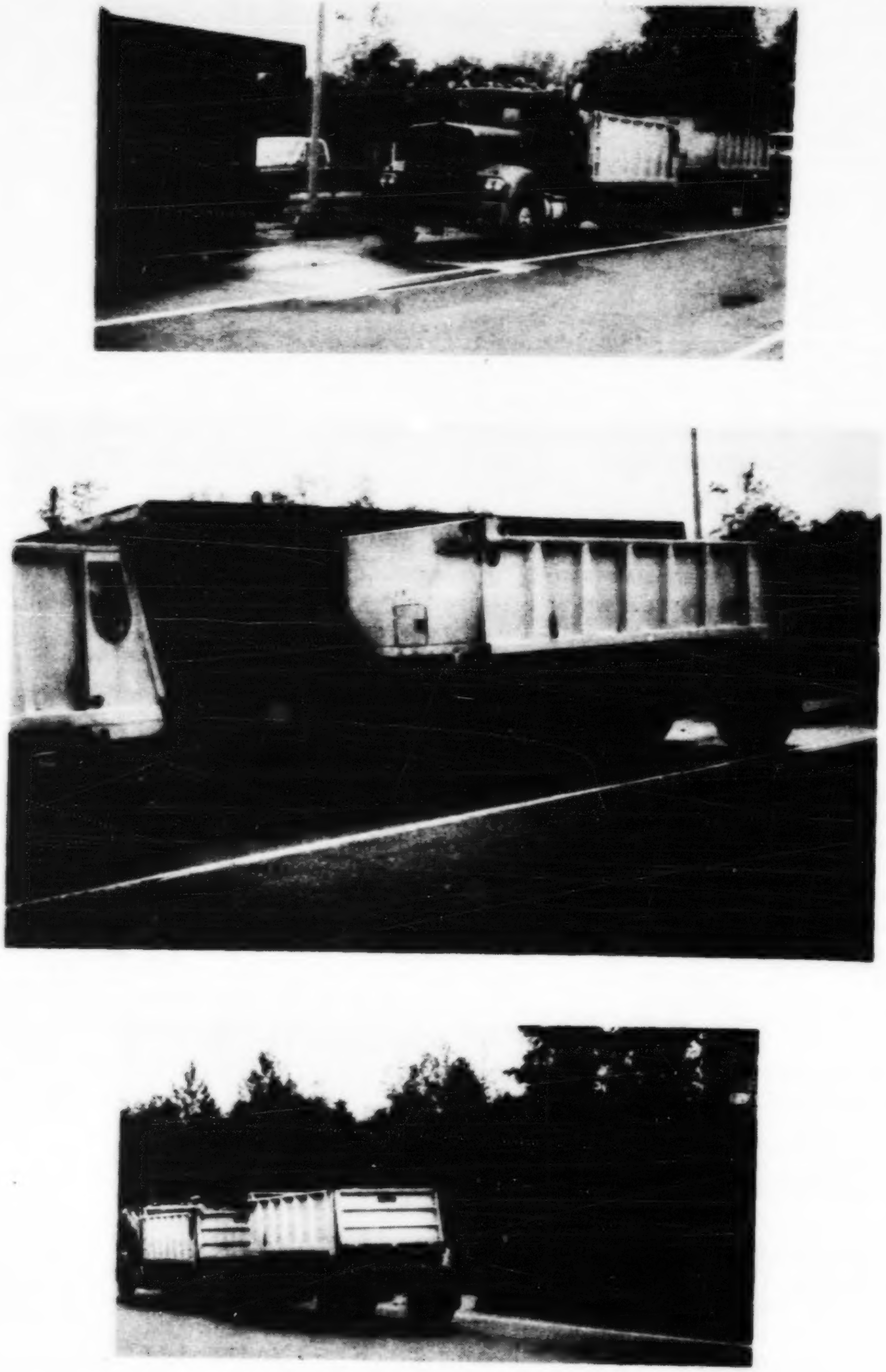


Figure 7.5.2 Gravel Truck (3-2)

V W D

Figure 7.5.3 Gravel Truck: 3-3 & 3-2 (pony)

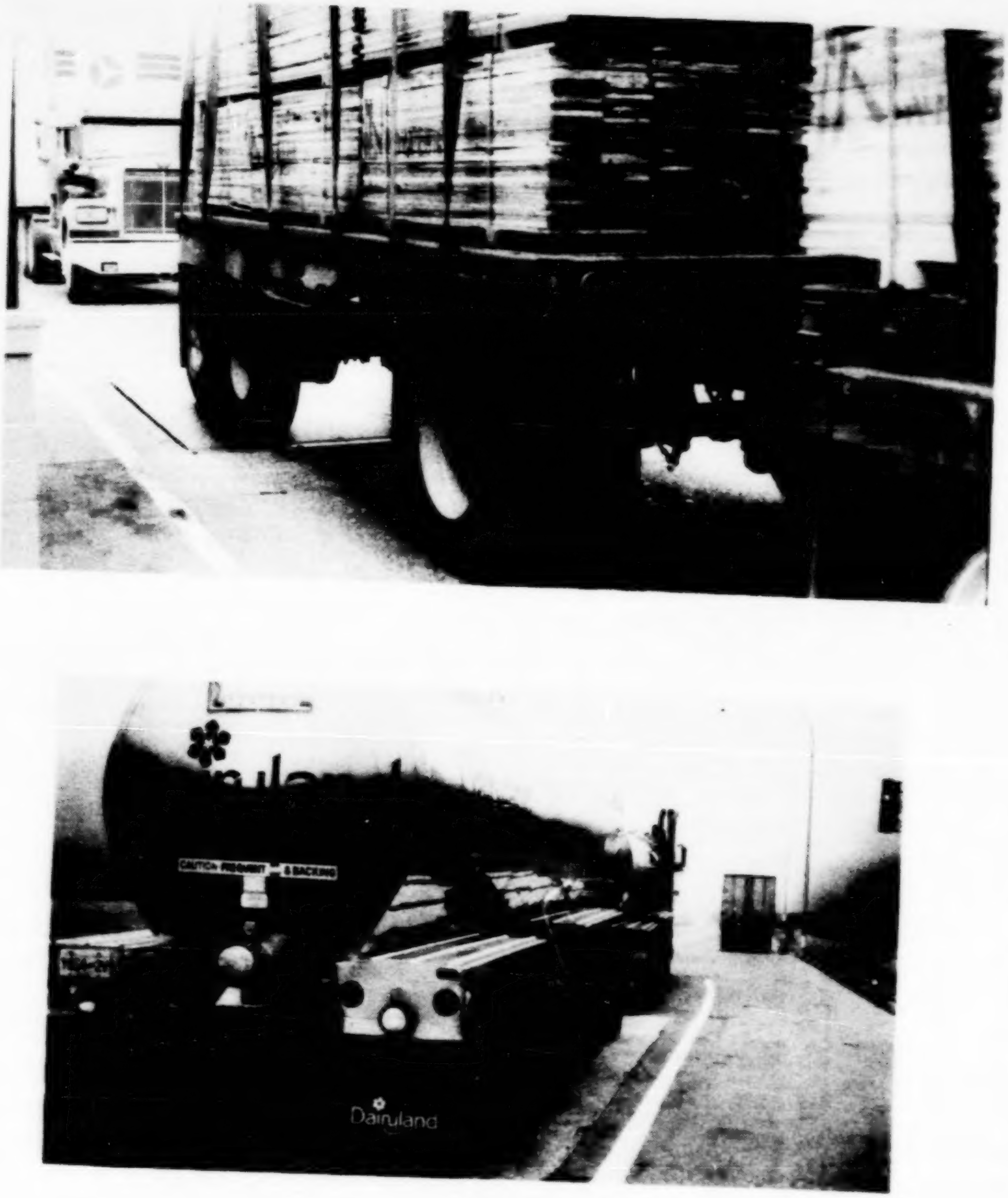

Dairyland
CAUTION: FREQUENT ... & BACKING
Dairyland

Figure 7.6.1 British Columbia: Single-Tire Axles

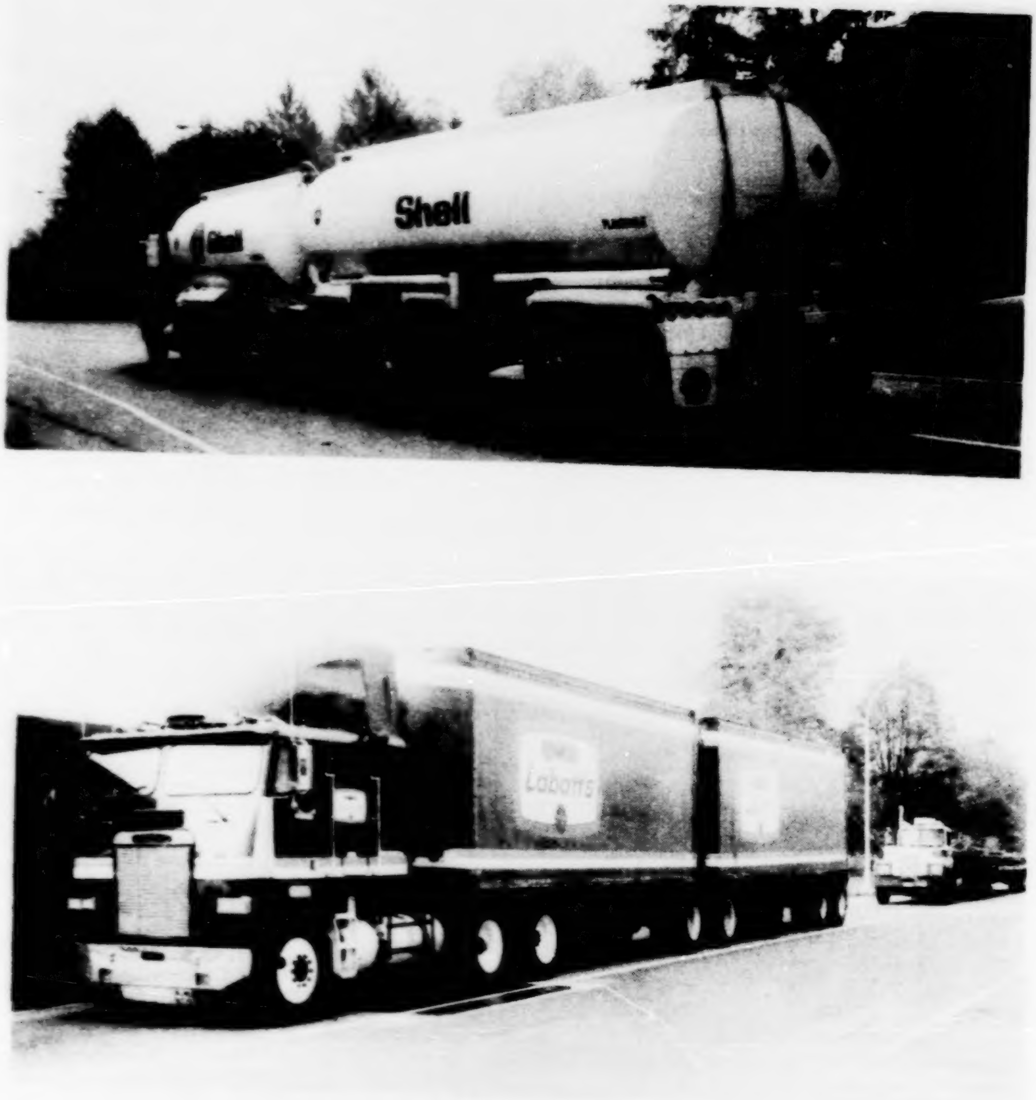

Shell
Labatts

Figure 7.6.2 British Columbia: 3-S2-S3

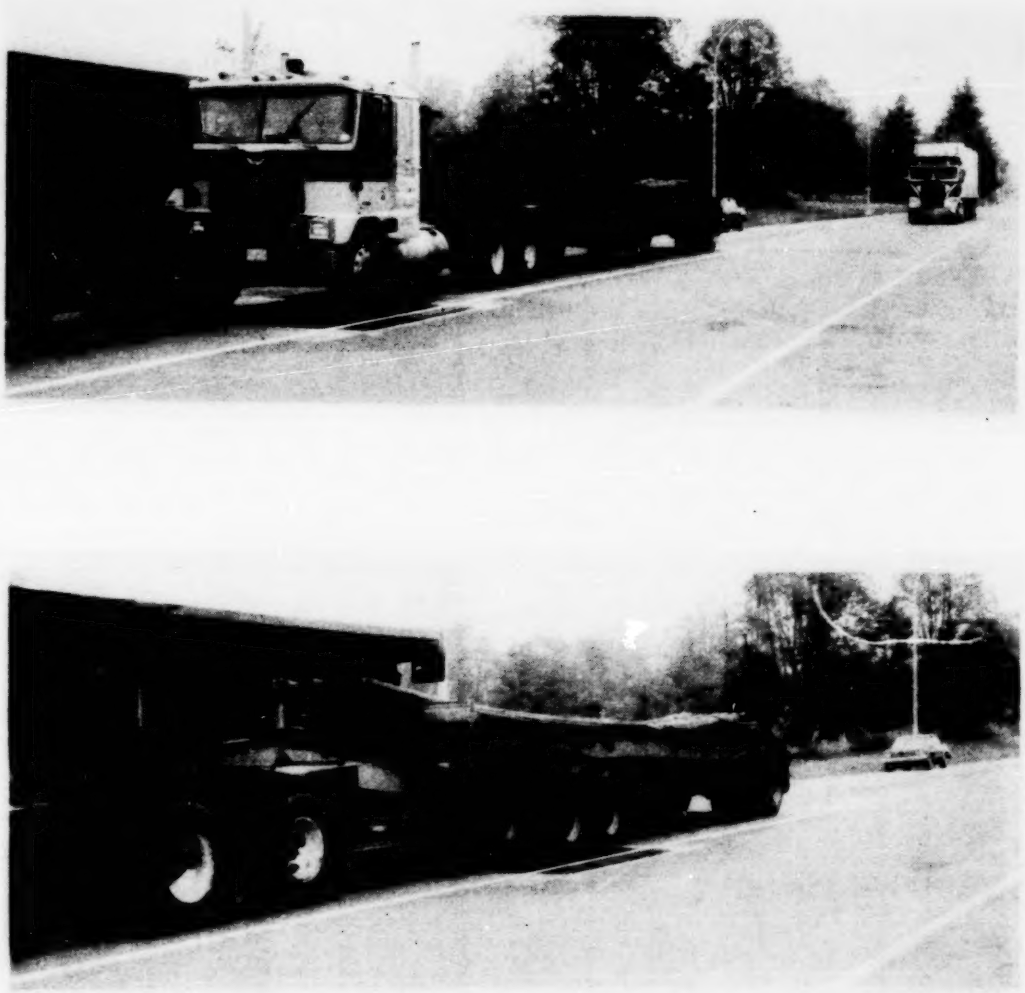


Figure 7.6.3 British Columbia: 3-S2-S2 (3-S2 with 2-axle jeep)

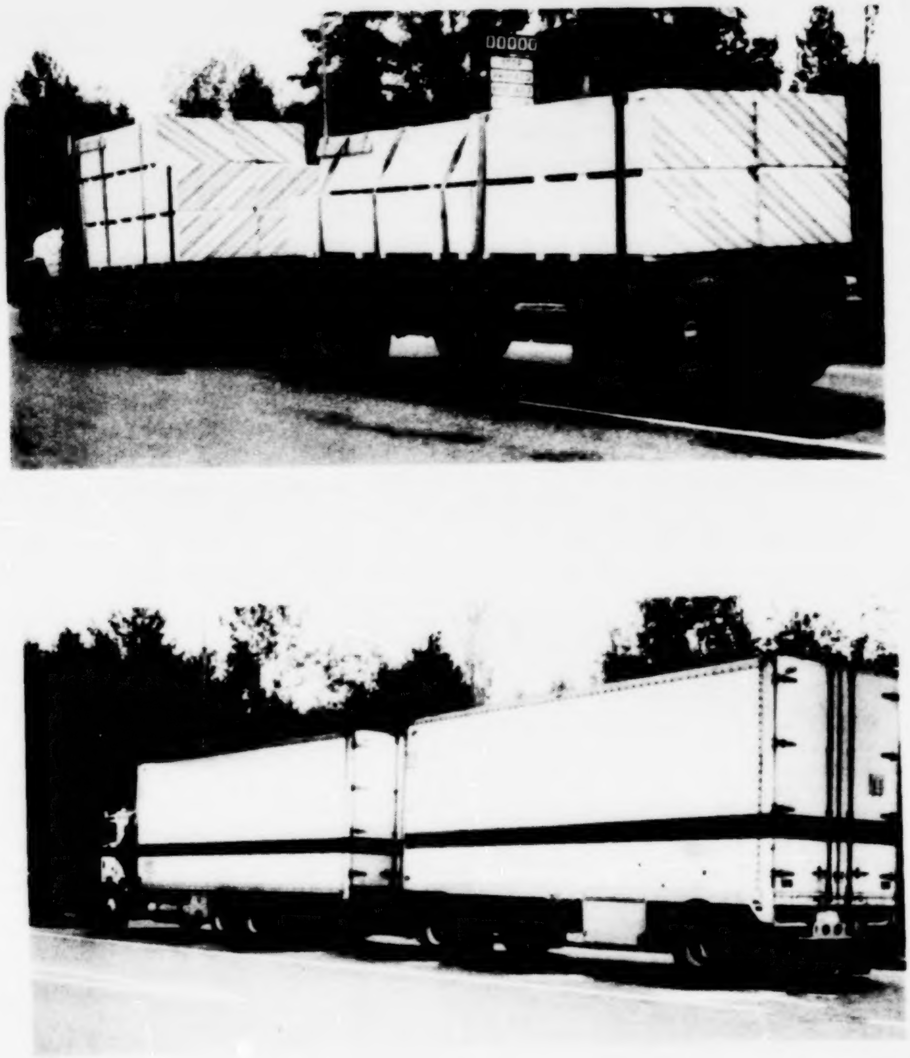


Figure 7.6.4 British Columbia: Truck + Trailers (3-2)

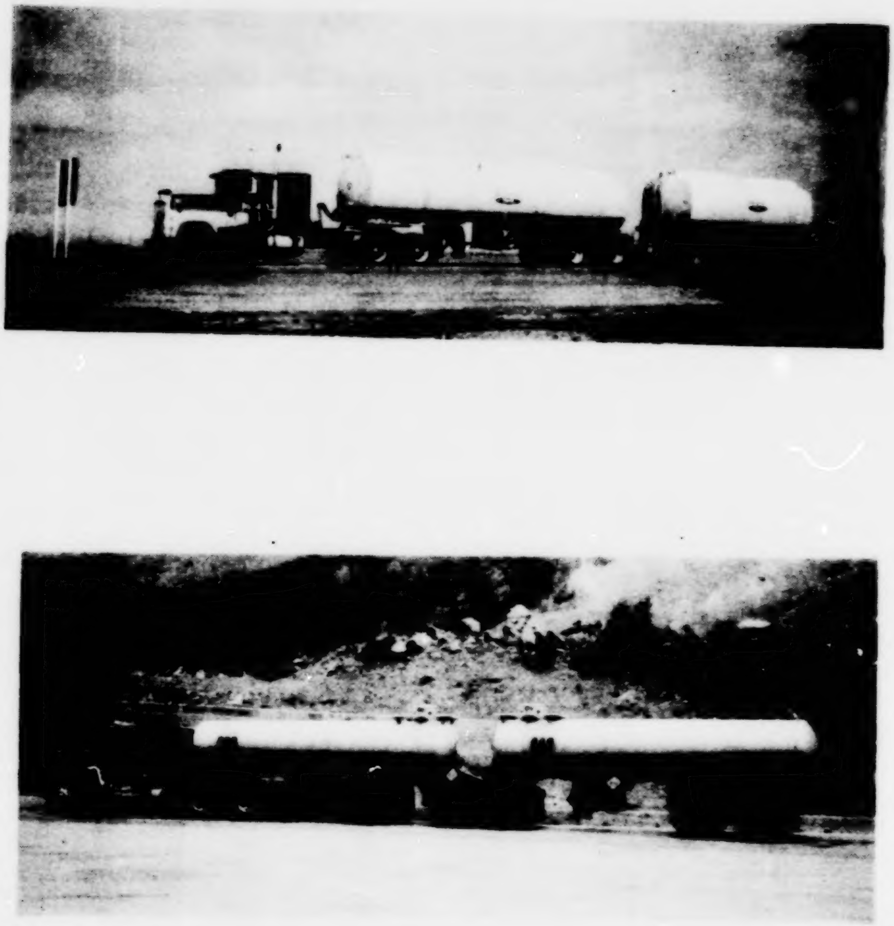


Figure 7.6.5 British Columbia: Tank Trucks

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